THE JOURNAL

of the

ALABAMA ACADEMY

OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 32 JANUARY, 1961 NUMBER 1

A T T E N T I O N

Pages in this issue are numbered 477 through 548. In view of the fact that this issue begins a new volume, pages should have been numbered 1 through 72. The next issue will start with page number 73. In the future, the volume will be issued on a calendar year basis: January, April, July and October.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 32 JANUARY, 1961 NUMBER 1

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

The Changing Black Belt — A Geographical View*

J. Allen Tower

Birmingham-Southern College, Birmingham

In antebellum days, the center of plantation development, slaveholding, and cotton production was the region of Alabama called the Black Belt. This was the area of greatest prosperity, with a cultured planter class dominating the political scene in the state. Despite the many changes which have occurred in the region and the state since then, Black Belt political power remains and is manifested every time the question of reapportionment of representatives comes up in the State Legislature. This interesting area is also the part of Alabama which has undergone the most radical change in land use.

The Black Belt is a strip of land from 20 to 40 miles in breadth, extending across the state from Pickens and Sumter Counties in the west to Russell and Barbour Counties in the east (see Fig. 1). This zone includes all or parts of 18 of Alabama's 67 counties. It contains three landscape elements: the Selma Chalk lands, the alluvial bottomlands, and the Chunnennuggee Hills. Harper (1) estimates their total area at some 6,500 square miles.

The Selma formation has three subdivisions: the lower marl (unnamed), the Arcola limestone, and the Demopolis limestone. The lower marl weathers into a deep black clay soil in an area of gently rolling lands with local relief typically under 80 feet. Some phosphatic materials lie at the base of the marl. The outcrop of this marl is some eight miles wide west of Montgomery, narrower to the east. It is, in a sense, the very heart of the Black Belt. Monroe points out, "For generations this part of Alabama has been considered the prime agricultural land of the state" (2). The narrow Arcola limestone outcrops as a cuesta or ridge usually from 50 to 100 feet high. To the south lies the Demopolis limestone which outcrops in a belt some 10 miles wide to the west of Montgomery County, narrowing to the east. Local relief in this sector varies from about 50 feet in the middle to 100 feet along

---

* This is one of four papers presented as a symposium on the Black Belt in Section IV, Forestry, Geography, and Conservation, at the 1960 annual meeting.

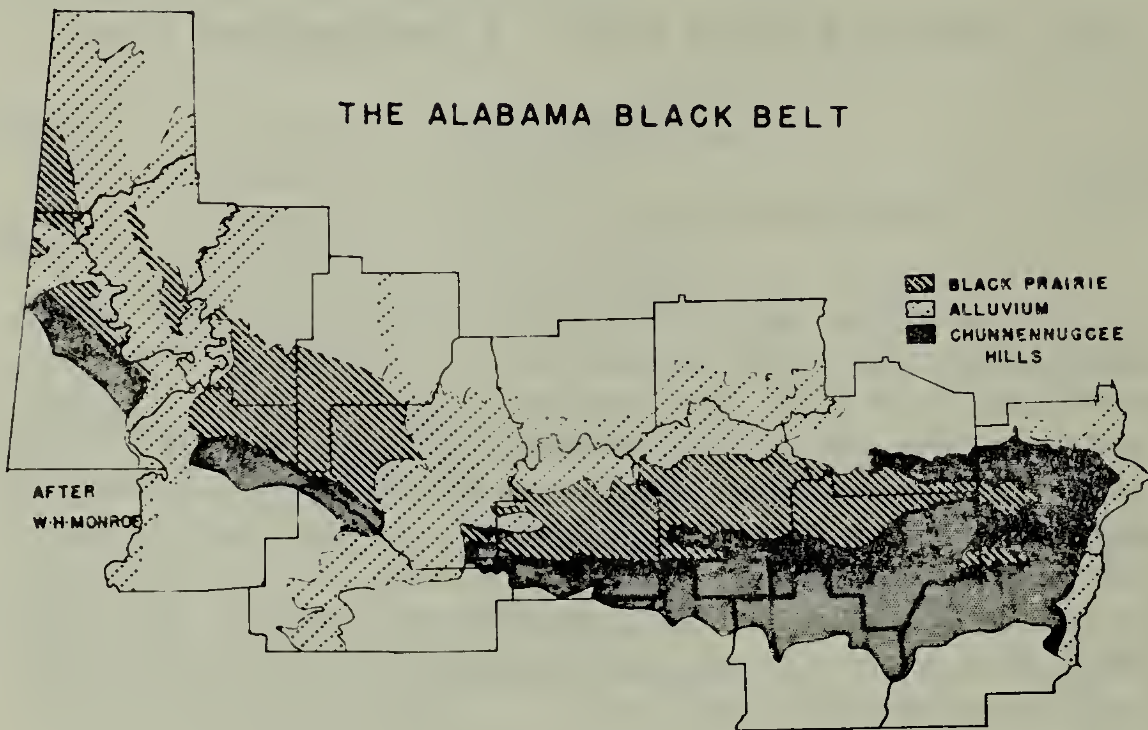


Fig. 1. The Alabama Black Belt.

the southern edge. This gently rolling landscape has thin soils and many "bald spots" where soil erosion has exposed the limestone. In Bullock and Barbour counties is the small Cowikee Prairie, some 3 by 10 miles in size, where erosion by the South Fork of Cowikee Creek has exposed the lower marl of the Selma.

The Chunnennuggee Hills to the south and east of the Selma are composed of rocks of several formations. These predominantly sandy rocks vary from gravelly to chalky sands, but include some clay materials and even some limestone. The base of each formation outcrops as a cuesta, with the formation dipping southward more steeply than the slope of the land. The Sand Fort cuesta of the Blufftown formation is a ridge up to 200 feet in height in Macon and Russell counties. The Enon cuesta at the base of the Cusseta sand formation forms a steep north-facing hill as much as 200 feet high in Bullock, Barbour, and Russell counties. The High Ridge cuesta at the base of the Ripley formation stands above the Demopolis limestone from Montgomery County west into Mississippi, where it forms the Pontotoc Hills; to the east it overlooks the sandy Cusseta lands, extending to the Chattahoochie River. In places this cuesta is 100 to 150 feet high. Its rocks vary from a hard sandy limestone to some clays. From Bullock County west, the lower dip slope exposes the Prairie Bluff Chalk formation. From Lowndes to Barbour counties to the south lies the

100- to 200-foot-high Lapine cuesta of the Providence sand. Farther to the south lies the Southern Red Hills area with its basal Midway formation outcropping as the Troy cuesta. The Chunnennuggee Hills consist, therefore, of a series of ridges with gentle southern slopes. Soil materials are predominantly sandy, but vary from limestone and chalk through clays to some gravels.

The third element in the Black Belt is the broad expanse of alluvium along the main streams, especially the Chattahoochie, Alabama, Warrior, and Tombigbee Rivers. Some of the older and higher terraces are gravelly to sandy, with silty and clay soils dominating the first bottoms (3).

Originally, this Black Belt area was not prairie country but rather an open hardwood forest with "grassy openings" covering 5 to 10 per cent of the land (4). The term "black prairie" is, therefore, a misnomer. The more common name, the Black Belt, refers to the prevailingly black clay soils on the Selma formation and partly on the alluvium.

Despite the agricultural fame of the region, initial settlement in the Black Belt lagged. The first permanent white settlement seems to have been the French "Vine and Olive Colony" at Demopolis in 1817. Perry County illustrates the lag. Five townships of 112,565.5 acres are on the Selma formation. The early settlers, from 1816 on, were on the upland to the north. Sales of land in the five townships accounted for only 17,418 acres from 1819-1829. But from 1830-1835, some 91,394 acres were sold. There were several reasons for this lag. The Chalk is impervious to water, so local streams are intermittent. Perennial streams originate outside the belt or on the alluvium. The lack of surface water supplies required the development of cisterns and wells bored 600 or even over 1,000 feet (6). The stickiness of the clay soils after a rain led to doubts of the fertility of the soil, while the muds and the morning mists raised doubts regarding the healthfulness of the area. Local tradition has it that these issues were settled by several experimentally minded farmers. Each built a hut on a clay tract and installed a Negro slave there with tools and supplies. For several months these slaves prospered and got fat. As a result, many plantations were promptly established in the early 1830's. Their development was also aided by a new blight-proof variety of upland cotton which proved to be suitable. In Montgomery County the pattern was similar (7). Land sales, which began in 1817, were initially in the bottom and terrace lands of the Tallapoosa and Alabama Rivers, with some sales to small farmers in

the south in the Chunnennuggee Hills. In the 1830's, planters occupied the Selma Chalk.

Similar developments occurred elsewhere, with the result that the region rapidly emerged as the dominant plantation area of the state. Mainly because of water shortage, towns and cities—such as Montgomery, Selma, and Marion—developed not on the Selma Chalk, but on the alluvium or on the fringing uplands. Many planters lived in these towns most of the year. Their affluence was partly expressed in a drive for culture. The town of Marion early developed three colleges: The Methodist Marion Female Seminary in 1836, Judson Female Institute (now Judson College) in 1838, and the Baptist Howard College for men in 1842.

The Civil War and Abolition forced one change on the region —a shift from a planter-and-slave operation to a system of land lords and share-cropping Negro tenants. But the basic characteristics of a predominantly Negro population and a stress on cotton remained. Eugene A. Smith, writing in 1880 of the Black Belt and its fringing areas, reported: " . . . we find that over 55 per cent of the colored population of the entire state is to be found in the central cotton belt, where about 60 per cent of the cotton is produced." He also pointed out the evil effects of soil erosion and the use of share croppers, which resulted in an average cotton yield of only 0.27 bales per acre (8). As late as 1910 this pattern remained essentially unchanged. Cotton acreage as a proportion of harvested acreage in 1909 varied from 75.6 per cent in Marengo County to 54.2 per cent in Barbour (9). Lethargy and poverty, drabness and nostalgia for the antebellum days prevailed except in a few rare towns with industrialization efforts (10).

The years since then have been a time of great transformation in the region. While the development of roads and automobiles and the wider horizons generated by World Wars I and II have had their effects, the arrival of the boll weevil in Alabama in 1912 resulted in radical change. To combat the weevil, early-maturing varieties are used, and they require early planting in the spring. The clay soils of the Black Belt stay wet and unworkable late in the spring and so now are unusable for cotton. Cotton today is raised on sandy soil primarily.

Harvested acreage has been cut drastically, and cotton's proportion of this lesser acreage has also dropped to under a half of its old figures. From 1909 to 1954 cotton acreage decreased 91 per cent in Montgomery County, 90 in Lowndes, and 78 in Greene,

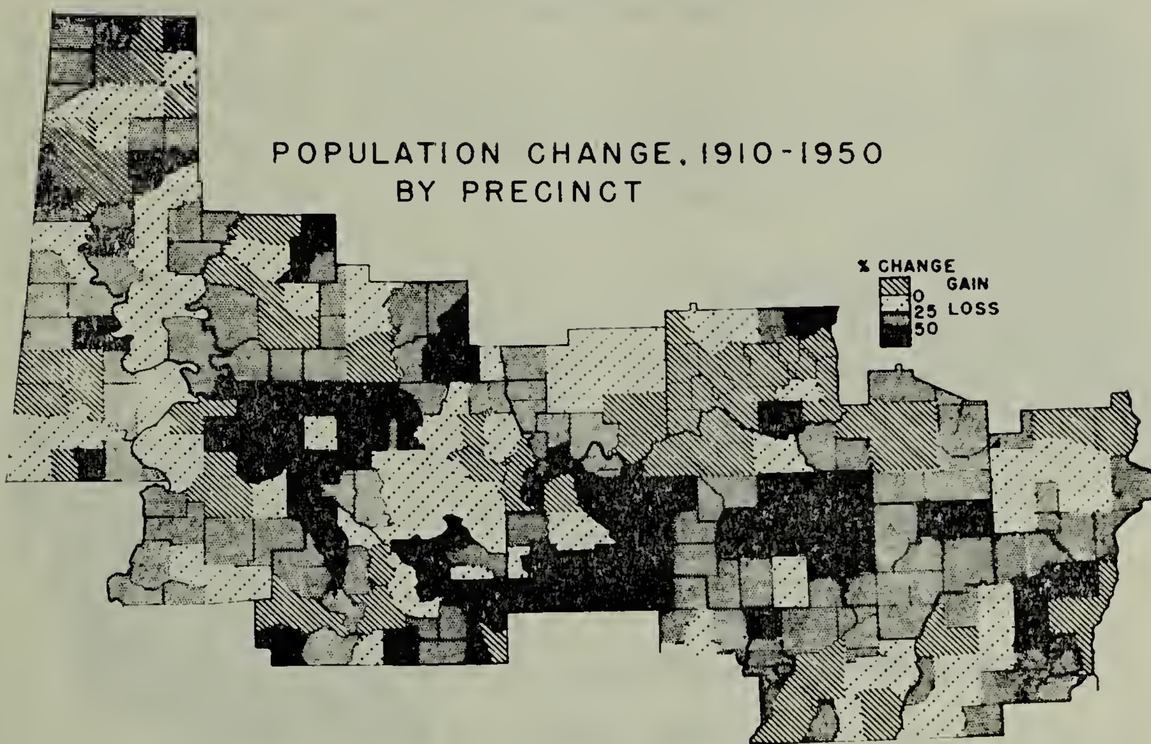


Fig. 2. Population change in the Black Belt, 1910-1950.

while cropland harvested decreased 60 to 70 per cent in these three counties. Pasture land increased from 11,000 to over 350,000 acres in Montgomery County, with a similar change in the other counties. The number of farms has been cut from one-half to two-thirds, as plantations are again being operated as units. Cattle have become dominant in the landscape. Their numbers have increased in Montgomery County from 22,572 in 1910 to 91,243 in 1954, while in Lowndes they have increased from 21,773 to 60,096, and in Greene from 16,070 to 31,178 (11).

Along with this shift from crops to livestock and pasture have come radical changes in population (12). Fourteen of the 18 Black Belt counties decreased in population from 1910 to 1950; only four had gains, caused mainly by the growth of the cities of Montgomery, Selma, and Phenix City (see Fig. 2). More than a fifth (22.6%) of the precincts decreased over half in population; and another third (35.4%) decreased from 25 to 50 per cent. Only a fifth (20.9%) showed increases, mainly in urban and in some alluvial areas. The Black Belt cities and towns have not been too successful in getting new industries, although a few have come to several. Most of the population exodus has consisted of Negroes. Released by the land use shift to farm activities needing less labor, they have gone to cities, seeking work and some freedom from customary social restrictions.

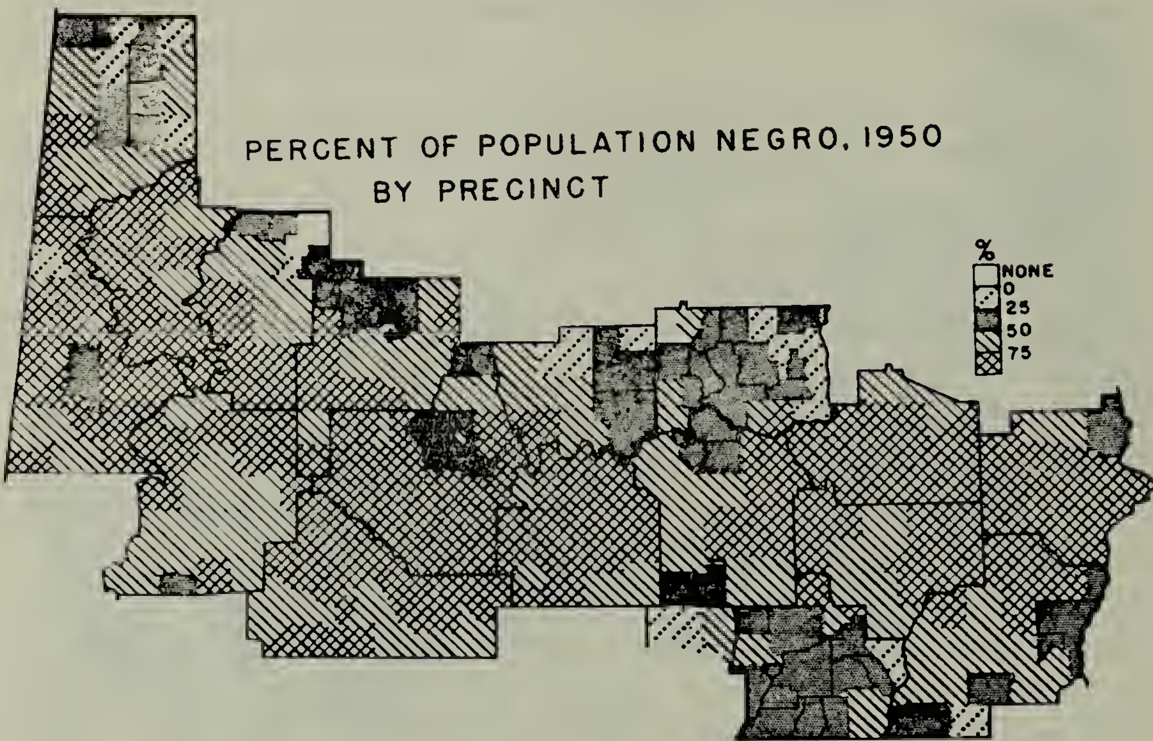


Fig. 3. Per cent of population Negro, 1950.

Nevertheless, the basic stock of the Black Belt population remains Negro (see Fig. 3). Out of seven counties in the South with over 75 per cent Negro population in 1950, one was in Mississippi, one in Virginia, and five in the Alabama Black Belt. Macon's 84.4 per cent was the highest in the South; Greene, Lowndes, Wilcox, and Sumter were also in this class. The map shows 44 per cent of the precincts, nearly all of those on the Selma formation or extensive alluvium, having over 75 per cent Negro population; the highest proportion (99.9%) is in Gee's Bend precinct in Wilcox, with three whites and 1,210 Negroes in 1950. An additional quarter (28.1%) of the precincts was from 50 to 75 per cent Negro. Only in urban and fringing areas was the proportion less than half, with three precincts on the upland to the north with no Negroes at all.

Such is the area considered by our symposium today: an area of marked soil characteristics, of radically changed agriculture, and of significant population decrease but with Negro majorities continuing to dominate the scene.

REFERENCES

1. R. M. Harper: *Forests of Alabama,* Geol. Sur. of Ala. Monograph 10, 1943, pp. 152-166.
2. Watson H. Monroe: *Notes on Deposits of Selma and Ripley Age in*

Alabama, Geol. Sur. of Ala. Bull. 48, 1941, p. 57.
3. Monroe: *op. cit., passim.*
4. Erhard Rostlund: "The Myth of a Natural Prairie Belt in Alabama," *Annals of Assn. of American Geographers,* Dec. 1957, pp. 392-411.
5. W. T. Jordan: *Antebellum Alabama, Town and Country,* Tallahassee, 1957, pp. 22-40.
6. Monroe: *op. cit.*, p. 34.
7. Warren J. Smith: "Land Patterns in Antebellum Montgomery County, Alabama," *The Alabama Review,* July 1955, pp. 196-208.
8. Eugene A. Smith: *Report on the Cotton Production of the State of Alabama,* in *Tenth Census,* Vol. VI, Part II, 1881, p. 62.
9. Calculated from the 1910 Census.
10. Glenn Sisk: "Post-War Vigor and Industry in the Alabama Black Belt," *Miss. Quarterly,* Spring, 1959, pp. 92-96.
11. Data from 1910 and 1954 Censuses.
12. Calculated from Census data for 1910, 1920, 1930, 1940, and 1950.

Historical Aspects of Forests and Vegetation of the Black Belt*

J. M. Stauffer

Alabama Department of Conservation, Montgomery

The Black Belt is the well-known central portion of Alabama, lying within the Coastal Plain, that derives its name from the color of the soil. When the area was first settled, the soil contained so much organic matter that it was almost black.

The characteristic soil is derived from the Selma Chalk (formerly called Rotten Limestone) which is one of the Cretaceous formations. The rock is a soft, gray, argellaceous limestone. According to Harper, "It weathers into a gray clay of exceptional fertility but somewhat difficult to cultivate, because it bakes hard in summer and becomes very tenacious mud in winter. Chemical analyses of this soil made under Dr. Smith's direction at the time of the Tenth Census show 1 to 2% lime, 0.20-0.44% of potash, and 0.10-0.51% of phosphoric acid."

Under the drying effect of a hot summer sun the soil contracts which results in very deep cracks as much as 1½ inches wide. Under the influence of ample rainfall, the soil expands and becomes saturated to the point where it is impervious to additional moisture.

The Black Belt, also called the "cane-brake or prairie region,"

*This is one of four papers presented as a symposium on the Black Belt in Section IV, Forestry, Geography, and Conservation, at the 1960 annual meeting.

extends into Mississippi and Tennessee. It includes all or parts of Bullock, Dallas, Greene, Hale, Lowndes, Macon, Marengo, Montgomery, Perry, Pickens, and Sumter counties. It is reported by Mrs. Marie Bankhead Owen in *The Story of Alabama* to contain 4,365 square miles or 2,793,600 acres. By planimetering the clay soils comprising the Black Belt (black clay over chalk, black clay soils on flood bottoms, gray sticky clay soil on nearly level relief, and grayish brown to reddish brown acid clays) the gross area was found to be 2,378,276 acres. The difference in area is understandable when one takes a look at the soil map. The Black Belt is not an unbroken continuing zone, but is subdivided by the intrusion of soil types other than the gray to black sticky clays which are the typical "prairie" soils.

HISTORICAL BACKGROUND

The initial fertility of the soil and accessibility of water transportation made the Black Belt attractive to the large planters of cotton who came to the territory from Virginia, the Carolinas, and Tennessee at the time the federal government offered the lands of the public domain for sale. Prior to the invasion of Alabama by the boll weevil, the prairie soils were peculiarly adapted to the culture of cotton which accounts for the concentration of the Negro population on them. Here were located the large plantations about which so much has been written. In addition to cotton, considerable quantities of corn and other grains have been raised before and since the War Between the States. The Black Belt was the granary of the Confederacy and supplied the bulk of the grain needed by the Southern Army.

After Napoleon had been defeated at Waterloo and exiled to the Isle of St. Helena, many of his close friends and military leaders sought refuge in America. They formed an association known as the Vine and Olive Colony for the purpose of growing grapes and olives. By an Act approved March 3, 1817, Congress granted them a tract of land comprising four contiguous townships, each six miles square.

In the summer of 1817 the first colonists arrived in Mobile and journeyed up the Tombigbee River to White Bluff where they laid out a town which they called Demopolis.

The French exiles had many trials and tribulations from the very beginning. The young olive trees were not frost hardy. They were killed back each winter. Although new shoots would develop in the spring, they too would perish with the first frost.

The soil was not very well suited to the culture of grapes. The plants suffered from the dry summers. Had the vineyards been located 25 or 30 miles to the north, they might have flourished for wild grapes occurred there in abundance. As late as 1828 some of the settlers were still trying to cultivate the vine. Soon thereafter many left the area — some returning to France, others moving to neighboring cities.

DeSoto was probably the first European to travel through the Black Belt. The following account of his journey through Alabama is quoted from Dr. Erhard Rostlund's article, "The Myth of a Natural Prairie Belt in Alabama: An Interpretation of Historical Records":

> ALABAMA. In Ranjel's narrative of the march through Alabama, mention is made now and then of grapes, plums, oaks, pines, rivers, and of villages in which food was obtained — from which cultivated fields can be inferred — but otherwise nothing is said that can be construed as a clear reference to plains, prairies, savannas, or other types of open country. Elvas and Garcilaso do not have much more to say about the landscape, and like Ranjel they are mostly concerned with the settled and cultivated regions. The province of Coza or the land of the Upper Creeks, according to Swanton, extended from about Etowah and Calhoun counties in the Coosa River valley to the town of Talisi (Talise), which was situated on the left bank of the Alabama at Durand's Bend in Dallas County . . . ; and southwest of Talisi was the territory of the Mobile Indians, with their principal settlement at Mabila (Mauvila) somewhere in Clarke County. The land of Coza, Elvas reports, was "thickly settled in numerous towns with fields extending from one to the other, a pleasant place with fertile soil and good meadows along the rivers. Talisi was a large town, and on both sides of the river there were other towns, many corn fields, and an abundance of grain." The land of the Mobile Indians, Elvas continues, was also "fertile and well inhabited, with large towns surrounded by walls, but people were numerous everywhere (espalhada por todo o campo), the dwellings standing a cross-bow shot or two apart." Garcilaso says that the province of Coza was "so fertile and thickly populated that on some days the Spaniards passed 10 or 12 towns, not counting those that lay on one side or the other of the road," and Mabila he describes as situated on "a beautiful plain and surrounded by a wall as high as three men." We also learn from Biedma that Mabila was on a plain (Llano). From Mabila, DeSoto went almost due north to the Black Warrior River, passing through regions that Garcilaso calls "peaceful although unpopulated," but no mention is made by any of the chroniclers of plains, savannas, or other types of open land. The Choctaw Indians had settlements on the Black Warrior in later years, but if there was any open country in this part of Alabama in 1540 no record of it is found in the DeSoto narratives. After crossing the Black Warrior, the expedition

proceeded northwest through Greene and Pickens counties, marching for four days, as Garcilaso states, through level country (tierra Llana) that had only a few scattered villages. Ranjel and Biedma made no comments on this part of the route, and Elvas only says that the land was unpopulated.

In *Plant Life of Alabama,* Dr. Charles Mohr has this to say about William Bartram:

> *William Bartram.* The first description . . . is given by William Bartram, in his account of his memorable travels through the Southern States, in the years 1773 to 1778. This intrepid explorer of the botany of Southeastern North America entered the state to all appearance somewhere near the middle of its eastern border, at the old Muscogee town Uche (the site of which can at present not be exactly located) after a journey of three days reaching the Indian settlements at Tallassee on the Tallapoosa River. In his account of his travels from the Tallapoosa Valley to the coast Bartram depicts most graphically the features of the vegetation prevailing in the floral regions traversed. He passed through the subtropical zone, recognized by the long wreaths of the Spanish moss investing the huge limbs of venerable evergreen oaks (the laurel oak, mentioned by him as Quercus hemisphaerica), and huge magnolias, with the Cretaceous plain before him, which the traveler describes as a country with a rich black soil resting upon a chalky testaceous limestone clad with tall grasses and a variety of other herbage, most conspicuous among it tall rosin weeds (Silphium) with their large spikes of golden yellow flowers and a resinous substance exuding from the bruises and splits of the stem; beyond the plains a broken ground of hills and vales covered with forests of stately trees — locust (designated as Robinia, but most likely the honey locust), linden, mulberry, elm, hickory and black walnut, with the Southern crabapple, dogwood and redbud for the smaller tree growth; further south a generally level plain, with a lighter soil, pebbles and sand mixing with the surface soil, covered with an open forest of oak, hickories, ash, red buckeye, and the smaller trees mentioned above, associated with an abundance of chestnut and with pines (Pinus lutea, i. e. short-leaf pine, Pinus echinata) interrupted by expansive cane meadows and detached groves, in strong contrast with the gravelly and rocky hills and vales supporting the forests mentioned above.
>
> . . . .
>
> Returning to Mobile soon afterward, he started near the end of November, 1777, with a party of traders toward the Atlantic coast. After three days travel he arrived again at the settlements of the Creek Nation, between the falls of the Moclassee (Tallapoosa River) and the Indian town Alabama, near the confluence of the Coosa and the latter river. After a short rest, he again left the soil of Alabama by crossing the Chattahoochee River between the towns of Chehaw and Usetta (a short distance above the city of Columbus, Ga.).

Dr. Mohr's reference to the botanist, Samuel Botsford Buckley,

is interesting in the light of the latter's discovery of the Durand White Oak, also called Bluff Oak and Basket Oak.

> *Samuel Botsford Buckley.* Arriving in central Alabama, he settled in Wilcox County as teacher in an advanced school (about 1839). There, among the hills and vales of the Upper Division of the Maritime Pine Belt, and near the woods and grassy glades of the Central Prairie region, an inviting field was open to the botanist. In the prairie region he discovered that fine tree of the white-oak group named by him Quercus durandii (Q. breviloba (Torr.) Sargent) and in the hills Thalictrum debile, besides a host of other interesting plants heretofore unknown from the Southern States. He described his discoveries in the Proceedings of the Philadelphia Academy of Science.

PRESENT SITUATION

Forest Area. The Alabama State Commission of Forestry had the U.S. Census Bureau prepare a report, "Number and Acreage of Farms by Counties and Precincts, 1925." From this report, the forest area of each county and precinct was determined.

The First Forest Survey, 1934-35, gave the forest land by counties only, as did the Second Forest Survey, 1951-1953.

Since it is not feasible to consider an area smaller than a county in comparing statistical data that is compiled and reported on the basis of county units, the information on the forest resources of the Black Belt is submitted for 11 complete counties rather than parts of 11 counties. Thus the gross area under consideration is 5,461,800 (Second Forest Survey) acres rather than the 2,378,276 (1960 estimate) acres that are strictly "prairie" soils.

The total land area, the commercial forest area, and the per cent of forest land for the state and for the 11 Black Belt counties are given in the following tables:

	Total land area	Commercial forest	Per cent forest land
	State of Alabama		
1925 Census	32,748,029	22,572,868	68.93
1934-1936 Forest Survey	32,692,700	18,877,700	57.74
1951-1953 Forest Survey	32,689,900	20,756,200	63.50
	Black Belt Counties		
1925 Census	5,409,881	3,356,983	62.05
1934-1936 Forest Survey	5,434,900	2,576,500	47.40
1951-1953 Forest Survey	5,461,800	3,050,000	55.80

From the foregoing tables the following area relationships have been determined:

Total Land Area

1925 Census	16.52% in 11 Black Belt Counties
1934-1936 Forest Survey	16.62% in 11 Black Belt Counties
1951-1953 Forest Survey	16.71% in 11 Black Belt Counties

Commercial Forest Land

1925 Census	14.87% in 11 Black Belt Counties
1934-1936 Forest Survey	16.62% in 11 Black Belt Counties
1951-1953 Forest Survey	14.70% in 11 Black Belt Counties

Tree Species. Loblolly Pine and Shortleaf Pine grow naturally throughout the Black Belt. These two species are the source of the major portion of the pine lumber and pulpwood produced annually.

Longleaf Pine occurs sparingly on the sandy soils in Lowndes and Dallas counties. Lowland Spruce Pine is found in the second bottoms associated with numerous hardwood species. Although Slash Pine is not indigenous to the area, this species has been planted extensively in practically every county and appears to be growing very well.

Red Cedar is quite common on the chalk outcrops while Bald Cypress is found growing in the swamps and sloughs.

Willow, Water Hickory, Cottonwood, Red Birch, Water Elm, Sycamore, Silverleaf Maple, Box Elder, and Southern Catalpa are found along the edges of creeks and rivers.

The bottomlands, particularly the second bottoms, support a growth of Blue Beech, Magnolia, Beech, Swamp Post Oak, Swamp Chestnut Oak, Cherrybark Oak, Water Oak, Willow Oak, American Elm, Hackberry, Mulberry, Yellow Poplar, Red Bay, Red Gum, Holly, Florida Maple, Basswood, Red Maple, Southern Silver Bell Tree, Black Haw, and White Ash.

On dry soils are found White Hickory, Post Oak, Southern Red Oak, Turkey Oak, Black Jack Oak, Haw, Red Bud, Black Gum, and Dogwood.

White Oak prefers a good, well-drained soil. Black Walnut, which has become rare in recent years, is found only on the richest soil.

The nature and quality of the soil determines the association of species not only in the bottomlands but also on the dry sites. For instance Turkey Oak, Black Jack Oak, and Dogwood are found in

association with Longleaf Pine. Basket Oak (Quercus durandii) is primarily restricted to a chalky soil.

Red Gum from the bottomlands and sloughs, various species of Oak (including White Oak and Cherrybark Oak), Yellow Poplar, Hackberry, Cottonwood, Beech, Ash, and Sycamore provide most of the hardwood lumber that is cut annually in the area.

One large sawmill that manufactures both pine and hardwood lumber utilizes 33 species. The hardwood species in order of importance are Yellow Poplar, Red Oak, Gum, and White Oak, with all other species grouped as miscellaneous.

Production of Forest Products. The Black Belt is an important producing area of forest products. This is sometimes overlooked in the light of the publicity, past and present, which has attended cotton and beef cattle production.

From the annual reports prepared by the Alabama Department of Conservation, Division of Forestry, on the production of forest products by counties, which are based on payments of the Forest Products Severance Tax, it is possible to determine the products that are grown and harvested in each county. By compiling the forest product statistics for the five-year period 1954-1958 inclusive, it has been determined that the average annual production for the Black Belt counties amounted to:

13.18% of the total pine lumber production of Alabama
20.86% of the total hardwood lumber production of Alabama
15.84% of the total pine and hardwood lumber production of Alabama
15.95% of the total pulpwood production of Alabama

As stated previously, the Black Belt contains 16.71% of the total land area and 14.70% of the total commercial forest land area of Alabama.

Forest Industries. In February 1956 the Division of Forestry made a statewide survey of forest industries by counties. This survey shows for the 11 Black Belt counties: 111 sawmills, 37 planing mills, 10 producers of sawed ties, 33 concentration yards, 78 logging contractors, 27 pulpwood producers, 12 veneer plants, 8 specialty mills, 2 box and crate factories, 4 producers of poles and piles, 2 treating plants, and 1 slab debarker and chipper. Since this survey, a pulp and paper mill has been constructed and placed in operation in Marengo County.

Products include pine lumber, hardwood lumber, sawed ties, veneer, bats, handles, flooring, table legs, hickory squares and di-

mension stock, ladder rounds, chicken crates, poles, piles, treated lumber poles and piles, pulpwood, and pulpwood chips.

Reforestation. The planting of trees for timber production in the Black Belt has kept pace with the rest of the state. For the five planting seasons 1954-1955 to 1958-1959 inclusive, 504,203,868 trees were planted in Alabama. Of this total, 72,455,042 were planted in the 11 Black Belt counties. This represents 14.37% of the total trees planted and is particularly significant in view of the fact that 16.71% of the total land areas and 14.70% of the total commercial forest land are in the 11 Black Belt counties.

SUMMARY

The Black Belt has had an interesting history. Through this region passed DeSoto and other early explorers. William Bartram, the botanist, touched portions of it on his travels in the state. The fertile black soils attracted cotton planters from other states who were looking for new and cheap lands to cultivate. Prior to the coming of DeSoto, the Indians worked considerable acreage for the production of corn and other foodstuffs. The Vine and Olive Colony established the city of Demopolis and attempted to grow olives and grapes. Until the coming of the boll weevil, cotton was king. With the decline in cotton production, the plantation owners turned their attention to dairy and beef cattle production. With very little fanfare the trees grew, were harvested, and processed into consumer goods for which there was a market, ready and waiting. When finally the spotlight is thrown on the timber resource, it is clearly evident that the tree crop is one of the supporting pillars of the Black Belt economy. As the records indicate, it is producing a proportionate share of Alabama's lumber, pulpwood, and other products; is reforesting a proportionate share of the state's idle and unproductive lands; and is protecting and managing the forest lands to the same extent as other sections of the state.

REFERENCES CONSULTED

Monograph 8 — Economic Botany of Alabama Part I — By Roland M. Harper

Monograph 9 — Economic Botany of Alabama Part 2 — By Roland M. Harper

The Story of Alabama — A History of the State — By Marie Bankhead Owen

Plant Life of Alabama — by Charles Mohr

The Myth of a Natural Prairie Belt in Alabama: An Interpretation of Historical Records — By Erhard Rostlund

Annual Reports of the Alabama Department of Conservation

Severance Tax Reports of the Alabama Department of Conservation

Progress in Soil Conservation in the Black Belt Since the Start of Soil Conservation Service*

W. C. Aiken

Soil Conservation Service, Selma

The Black Belt, as found in Alabama, is a long section of land extending from east to west that divides the Upper and Lower Coastal Plains. It is located in 13 counties and comprises approximately 1,700,000 acres. The soils of this region are heavy plastic clays with two main divisions — alkaline and acid soil. The Black Belt has both the strongest alkaline and the most highly acid soils in the entire state.

These soils in their original condition were highly productive. At one time the Black Belt led the state in the production of cotton and paid two-thirds of the state taxes. However, in 1914, with the coming of the boll weevil, its leadership of cotton production ended. It was not only the boll weevil but the effects of soil depletion that helped bring this about. The heavy clay soils eroded easily wherever they were clean cultivated with cotton. Nevertheless, for a number of years cotton stayed on as a chief money crop in spite of the boll weevil and erosion, although gradually the land use was shifted to pastures, hay, and small grain.

In 1939 and 1940 the farmers of the Black Belt voted in Soil Conservation Districts. Under the leadership of the District Supervisors, a concerted effort of conservation was started. By conservation I mean, "An economic use of a natural resource for the greatest good to the largest number of people for the longest time."

The District Supervisors entered into a Memorandum of Understanding with the Soil Conservation Service whereby the Soil Conservation Service would assist the Districts and the landowners (on their request) in the technical phases of agronomy, forestry, engineering, and biology that would result in better soil and water conservation.

The personnel of the Soil Conservation Service assists the landowner in planning the land use and treatment of his farm. There have been modifications and changes during the past twenty years, but the pattern has remained essentially the same. First, a soil scientist makes an inventory of the soil conditions of the

---

*This is one of four papers presented as a symposium on the Black Belt in Section IV, Forestry, Geography, and Conservation, at the 1960 annual meeting.

land. He records soil type, slope, degree of erosion, and land use. Then a soil conservationist — using the soils inventory and guides furnished by conservation specialists in agronomy, engineering, forestry, and biology — helps the landowner in fitting a conservation program to his land according to the capability of the soils. The soil conservationist and the landowner accomplish this planning by progressively going over the land and discussing the best uses for each soil and field. The conservationist assists in the planning by giving the owner the latest information obtained from experimental work at colleges, experiment stations, and other land-using agencies and from observations of other nearby soil conservation operations.

The plans as agreed to by the landowner are then placed on a map and included in a folder containing the soils information and the way that the conservation plan will be carried out. After approval by the Supervisor, this agreement constitutes a basic farm plan because it contains plans to conserve and use every acre. In the past 20 years 2,945 basic plans have been made. They cover 773,275 acres or 45 per cent of the total land area of the Black Belt.

The soil conservationist, his aid, his district supervisor, and others assist the landowner in establishing the practices that were planned. This has led to the terracing of 68,000 acres with 6,957 miles of terraces being built — enough to reach to the Pacific Ocean and back. A further result is that 70,900 acres of wet land, too wet for pasture and crop land and not suited or needed for water impoundment, have been drained with ditches 686 miles long — enough to traverse the length of Alabama almost three times.

To conserve water, 2,321 ponds have been laid out and constructed after sites had been tested for suitability. This one item will help to hold back run-off water and will serve as water reserve for stock watering and for recreation.

As the soils are particularly adapted for fine pastures, a larger part of the open land on these Black Belt farms has been developed into improved fertilized pastures. Over 300,000 acres of such pasture have been developed by district cooperators.

The Black Belt has never been thought of as a wood-producing area, but since the establishment of the Districts this important segment of land has come in for its share of conservation treatment. Higher stumpage prices and demand for wood have increased the interest in woodland work. Over 19,000,000 trees have been planted on the acid lands and bottoms. Thousands of acres have

been selectively harvested to insure continuous woodland production. Large areas have also had hardwood control applied to them to reduce the cull weed trees and improve the quality and growth of the timber stand.

The production of one of the early C.C.C. plantings in Hale County shows that timber production of acid bottom land will compare favorably with any other land in the state. This planting of 33 acres has produced $36.00 stumpage per acre and still has standing on the land 2,728 board feet of saw timber and 13 cords of pulpwood per acre. This amounts to $11.24 per acre per year. It has been thinned three times in 17 years.

In addition to these major agricultural phases of land use, the care and protection of wildlife have not been neglected. Numerous food and cover patches have been established for quail, several duck ponds have been developed and managed, and feed patches for deer and turkey are located on the farms of district cooperators.

A comparison of the 1934 census and 1954 census shows the following trend in land use and farming. The acreage in farms has declined slightly. But the number of farms has decreased 45 per cent, and they have more than doubled in size to an average of 167 acres. The crop land harvested has decreased 61 per cent, and the woodland has increased 3 per cent.

The trend in the Black Belt is similar to some of the other areas of the state. Livestock and timber farming continue to increase and play the major roles in land use in the Black Belt, with resulting better conservation of soil, water, timber, and wildlife. In fact, the pattern of land use in the Black Belt is similar to the adage of the Sphinx: "First a child, then a man, and back to a child"; or, first in grass and trees, then to row cops, and back to grass and trees. The Black Belt is fast returning to its early state as described by one of its first settlers, "A wide spreading plains of a level and gently waving land, without timber, clothed in grass, herbage and flowers, insulated by skirts of rich interval woodland and exhibiting in the month of May the most enchanting scenery imaginable."

Wildlife Resources of the Black Belt with Emphasis on What Is Being Done at Westervelt Game Preserve*

Howard R. Redmond

Gulf States Paper Corporation, Tuscaloosa

Within the last several years considerable attention has been focused on wildlife as a twin crop with timber in the Black Belt. Through better protection of existing game species, the Black Belt has become one of the better hunting areas in the South. Deer are found in almost all of the forests of the region. In every case where they have been protected, they have increased to a relatively high degree of stocking. Wild turkey exist in most of the area. They nearly became extinct in the late twenties and early thirties, but the population is growing at present. Good squirrel populations occur in practically all of the bottomland hardwoods. Quail flourish wherever the management of the species is given consideration. Large concentrations of doves are found where grain farming is carried on in conjunction with livestock farming. Winter duck populations are very good in the bottomlands of the Tombigbee River and other large streams where the right combination of shallow water and duck food exists.

In general, the Black Belt is rich in wildlife. However, the value of this resource can be expanded through proper management. Wildlife is a product of the land, and the way the land is managed has a major bearing on the size and quality of the wildlife crops.

The Westervelt Game Preserve, owned and operated by the Gulf States Paper Corporation, is the only forest area of the Black Belt that is considered to be under a sound wildlife management plan. Here, wildlife is given priority over timber production. This 10,000-acre Preserve is located about six miles west of Aliceville, on the flood plain of the Tombigbee River.

Gulf States Paper has other forest lands scattered throughout the Black Belt. Management of the other forests treats wildlife as a twin crop with timber — a program that is proving to be economically sound.

It is recognized that foresters in the Black Belt, taken as a

*This is one of four papers presented as a symposium on the Black Belt in Section IV, Forestry, Geography, and Conservation, at the 1960 annual meeting.

whole, are primarily interested in maximum timber production. But they have a growing concern with encouraging game production. The recommendations presented herein were formulated to meet the need for specific information indicating practices a forester can use to increase game populations without undue sacrifice of wood volume growth. They are based on observation and research extending over a long period of time and will apply to forest conditions in general throughout the Black Belt. They are not designed to develop a maximum game population, but are intended to suggest practices which are compatible with timber *and* game production. It is probable that the practices will result in a compromise between maximum timber production and maximum game production.

Recommended practices:

1. Bottomland hardwoods
   a. Leave all bottomlands, from those only a few feet wide to major stream valleys, in their natural timber stand composition except for normal improvement and harvest operations.
   b. Grow mast-producing trees to as large a size as is economically feasible.
   c. Keep fire out of hardwood bottomlands at all times.
   d. Attempt to have an all-aged stand of mixed species if possible.
2. Upland stands of mixed pine and hardwoods
   a. Leave groups of 30 to 40 mast-producing merchantable hardwoods on every 20 acres. Leave these hardwoods in groups of 10 or more.
   b. Maintain the hardwood composition permanently.
   c. Do not overcrowd these trees. The crown of each tree should have nearly full sunlight.
   d. Leave small seed-bearing shrubs and vines such as dogwood, huckleberry, persimmon, mulberry, and wild grape.

It is realized that no single set of recommendations could possibly apply to all of the various forest types. For best results, examination and analysis should be given each forest. If possible, the management treatment should be prescribed by a qualified forester in concurrence with a game management specialist.

The accepted cutting classifications are clear cutting, seed tree cutting, partial cutting, thinning, and salvage. Each of these has a direct effect on some species of wildlife. Clear cutting and

seed tree cutting, with controlled burning until regeneration is obtained, can benefit quail production. Partial cuttings, thinnings, and salvage cuttings open up small forest areas and yet leave sufficient cover for squirrel and turkey in most cases.

Deer are aided to some degree by all types of cutting. All of them open up the forest floor so that legumes, shrubs, and other herbaceous plants come in and thus a better deer habitat is created. Today, more deer can be supported in the South than ever before in the history of our country. This has been brought about by "game management" which was strictly accidental. The virgin forest, which afforded good turkey and squirrel habitat, has given way to the sprouting of brushy conditions in our reproducing cut-over lands, and this is providing excellent browsing for deer.

A good rule of thumb for deer habitat management is that if the *quantity* of available deer browse is increased, the *quality* of the browse is also increased. Decreased *quantity* of deer browse will likewise decrease *quality*. Any silvicultural practice which tends to increase the amount of available deer browse is good deer management. Examples are TSI, thinning, prescribed burning, and harvest cutting.

At this point we turn to a consideration of how Gulf States Paper Corporation is applying wildlife management on company-owned forest lands. Westervelt Game Preserve carries on an intensified wildlife program. In order of priority, the program is concerned with these species: (1) deer, (2) wild turkey, (3) quail, (4) duck, and (5) squirrel. The wildlife management practices include the sowing of both spring and fall food plots. At present there are about 120 acres of open land planted and maintained for game. The wildlife food crops consist of oats, clover, corn, soy beans, chufas, bicolor, mixed game-food plants, and brown top millet. Old beaver ponds and natural lakes are being developed and duck foods planted. Duck hunting here is expected to be among the best in the region within a few years. Runways have been established for wild turkey. These will also benefit and increase the quail population. Wild turkey have been released on the Preserve. It is hoped that these releases will not only provide good hunting in the immediate vicinity, but will also be a means of reestablishing turkey in southwest Pickens County — a result that is already coming about.

For the most part, all of the game management practices just mentioned contribute to the maintenance of an adequate habitat for deer. The food plantings and the forest afford ample browse.

The Preserve contains many oaks, and oak acorns provide much of the winter food. It has been found, however, that acorns are not essential to a good deer habitat as long as other browse is adequate. We may note that a major problem of deer management we face is over-population where proper protection is given.

Investigations made on the Preserve indicate that the carrying capacity for deer has been reached. During January and February, 1960, doe deer were trapped and taken away from the area. It is estimated that there are approximately 400 deer on the Preserve at present, and management will be directed toward maintaining a herd of this size. This means that about 80 deer of both sexes must be moved each year in the future. The removal of doe deer will be accomplished by live trapping and transplanting to understocked sections of other Gulf States Company forests. Eventually, desirable hunting populations will be developed for the general public in these other areas. If this control is maintained, the Westervelt deer herd will be the first controlled deer herd in Alabama or Mississippi. In fact, it could possibly be the first in the Southeastern United States.

Scientific studied are conducted on Westervelt Preserve to determine the best game management policies and techniques. Data are obtained by the examination of game killed on controlled hunts; live trapping, tagging, and releasing; deer browse studies; road track counts; and field observations. This valuable information is being collected in conjunction with, and made available to, the Alabama Department of Conservation.

Westervelt Game Preserve has now been under combined wildlife and timber management for six years. It is already being recognized that the two resources are compatible and that the combined system of management has improved the economic value of the land. This experience is having an effect on management policies and practices in the Company's other forests. Losses are expected to be small in terms of wood products, and these losses will be more than compensated for by augumented wildlife values.

Colorimetric Properties of Some Transition-Metal Gallates*

E. L. Grove, Lodric Maddox, and W. S. Jeffery

University of Alabama

INTRODUCTION

Gallic acid, one of the polyphenols, has received only limited study as an individual quantitative analytical reagent (3). However, it has had rather wide application as a qualitative reagent for spot tests. Das-Gupta (1) stated that gallic acid when used for the colorimetric determination of titanium could not be used alone but must have sodium acetate or ammonium acetate present. Karyakin and Telezhnikova (2) found that niobium formed colored complexes with certain polyphenols—namely, pyrocatechol and pyrogallol—only in an alkaline solution, while tantalum formed the colored complexes in only acidic solutions.

On this basis it may be possible to use gallic acid in a spectrophotometric procedure for both tantalum and niobium. Also, since it contains three phenolic groups, extraction techniques may be avoided.

In addition to the niobium and tantalum-gallic acid chelates the optical properties of several other metal chelates were explored.

EQUIPMENT AND REAGENTS

Beckman Model DU spectrophotometer with matched cells.

Leeds and Northrup pH meter with glass and saturated calomel electrodes. Calibrate the instrument with Coleman pH buffer tablets.

Normax and Exax volumetric ware; 10-ml. Exax burette calibrated to 0.02 ml.

Niobium pentoxide, tantalum pentoxide, titanium dioxide, ferric oxide, hafnium oxide, thorium oxide, vanadium pentoxide, zirconium metal, tungsten metal, and potassium perrehenate—each the most pure grade commercially available.

Acids: concentrated nitric and hydrochloric, and 48 per cent hydrofluoric, A.C.S. grade.

Gallic acid, sodium sulfite (anhydrous), potassium bisulfate, ammonium oxalate, oxalic acid, and potassium hydroxide.

---

*This research was supported by the U. S. Air Force Office of Scientific Research, Contract No. AF-18(600)-1567.

PROCEDURE

The sample of the oxide, equivalent to 0.2500 gm. of niobium pentoxide, was fused with 6 gm. of potassium bisulfate in a No. 3 porcelain crucible. After cooling, 10 gm. of ammonium oxalate and 50-60 ml. of water were added to the crucible and the contents warmed slightly till the melt loosened. The contents were transferred quantitatively to a 400-ml. beaker and warmed till the solution became clear. When cool this solution was transferred quantitatively to a 250-ml. volumetric flask and diluted volumetrically.

Zirconium, tungsten, and vanadium pentoxide were not fused but dissolved in acid. Zirconium metal was dissolved in warm aqua regia to which two drops of hydrofluoric acid had been carefully added, then evaporated to near dryness and taken up with water. Since the basic salts of zirconium precipitate easily, very dilute sulfuric acid was used instead of ammonium oxalate when the solution was diluted. Tungsten metal was dissolved in nitric-hydrofluoric acid and vanadium pentoxide in dilute aqua regia. To each of these the ammonium oxalate was added and then diluted volumetrically to form the stock solution.

Twenty grams of sodium sulfite and 5 gm. of gallic acid were dissolved in 150 ml. of water, then diluted volumetrically to 250 ml. Since the gallic acid solution was unstable a fresh solution was prepared every few days.

To 20-ml. aliquots of the gallic acid solution, the desired quantity of stock solution was added with the 10-ml. burette and the pH adjusted with oxalic or potassium hydroxide, then diluted to 50 ml. volumetrically. Absorbance measurements on these solutions were made against a blank prepared in the same manner.

To determine the effect of pH, solutions were prepared from pH 4 to 8 and the absorbance plotted against wavelength from 330 to 460 mu. All solutions contained 3.62×10^{-5} moles/liter (vanadium, 1.81×10^{-5}M) of the element so as to compare the relative absorbance of the different metal chelates. To check adherence to Beer's law the proper pH was selected and varying amounts of the element in solution were added to 20-ml. aliquots of gallic acid solution and diluted as indicated above.

DISCUSSION

The effect of pH on the absorbance of niobium, tantalum, and vanadium-gallate chelates can be summarized in Figs. 1, 2, and 3

respectively. Tantalum developed a yellow color at a lower pH than the niobium gallate. At pH 4 and wavelength 390 mu, and at pH 5, wavelength 350 mu, the tantalum gallate showed a definite color while the niobium gallate sollutions at the same pH and wavelengths showed no absorbance.

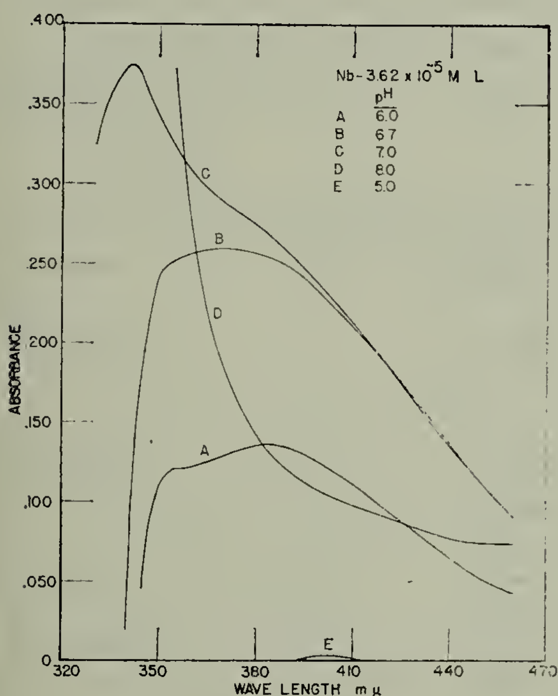


Fig. 1. Effect of pH on absorbance of niobium gallate solutions.

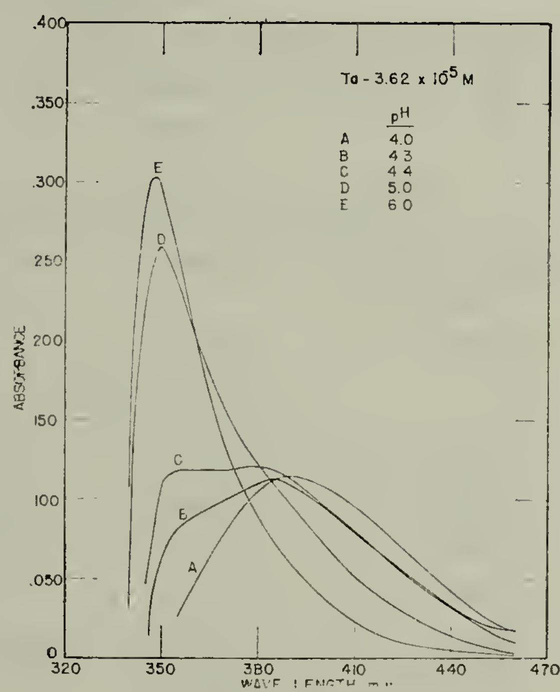


Fig. 2. Effect of pH on absorbance of tantalum gallate solutions.

The elements that were studied developed no color when the solutions were strongly acidic, except rhenium, which was a pale yellow. Color developed as the solutions were made less acid and became more intense and darker as the pH approached neutral to slightly alkaline. For the niobium and tantalum solutions the color changed from yellow to yellow-orange, and the maximum shifted toward the ultraviolet. The absorbance curves for vanadium gallate, Fig. 3, actually reversed from a poorly defined maximum to a minimum at 390 mu. Hafnium also showed nearly no color at pH 5.5 but absorbed very strongly at pH 8 and 335 mu. The niobium and tantalum solutions also absorbed very strongly at pH 8 and 335 mu; however, colors at this pH were unstable. The ferric gallate solutions changed from colorless to a slight bluish-purple at pH 4.3 and became very intense at pH 7. The titanium gallate solutions were yellow-orange; the color did not change greatly and the maximum did not change in wavelength.

Solutions with pH values from 4 to 8 were studied. At values

slightly more acidic a white granular precipitate formed and a gas evolved that appeared to be sulfur dioxide. As the pH was changed to neutral to slightly basic, the gallic acid was being neutralized so either more complete chelation or a new chelate was being formed and a stronger but darker color developed. The darker color at pH 8

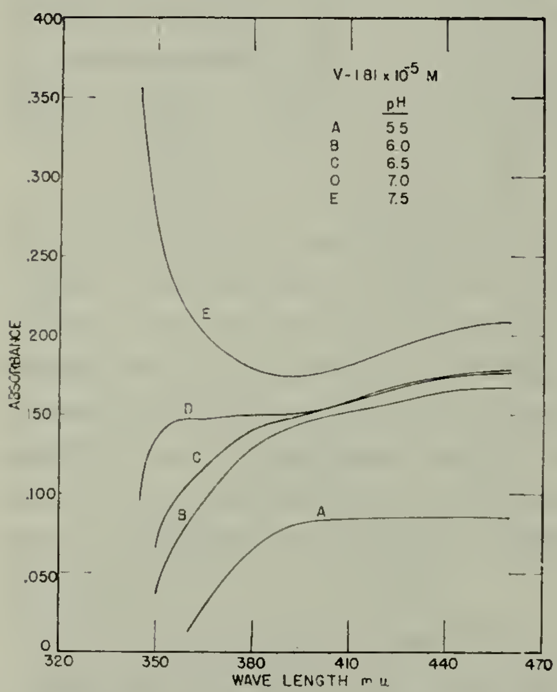


Fig. 3. Effect of pH on absorbance of vanadium gallate solutions.

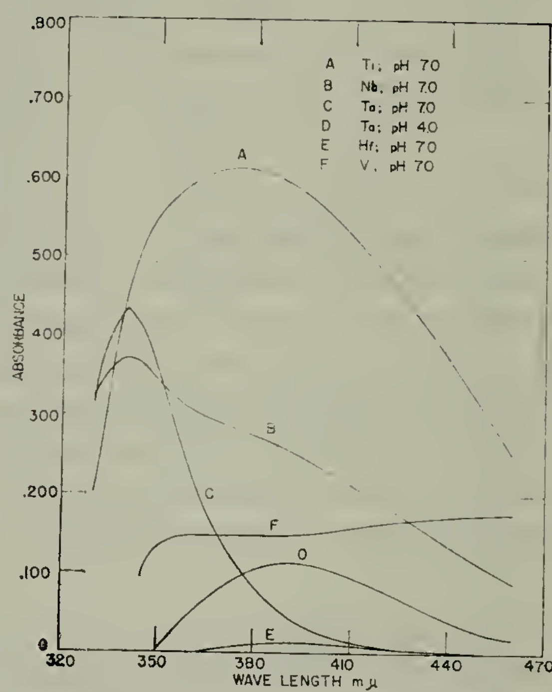


Fig. 4. Absorbance at optimum pH.

was also unstable. In some cases at pH 8 or slightly above, a discoloration began at the surface and extended down into the solution. The solutions darkened and some became nearly black. This was attributed to air oxidation.

Solutions containing the element and gallic acid produced color but it was unstable and faded quite rapidly. It was found that sodium sulfite would stabilize the color up to a period of 24 hours. However, after several days of exposure to sunlight the solutions became turbid. The amount of sodium sulfite apparently is not critical except for a lower limit. The color of the vanadium gallate solutions which were diluted with water by a factor of 2 was found to be unstable.

These metal gallate solutions that developed enough color adhered to Beer's law within limits. At the more concentrated solutions negative deviation was observed.

A comparison of the absorbance curves for the different metal gallates is illustrated in Fig. 4. For the same molar concentration the

titanium gallate exhibited much greater absorbance than the other elements studied. Hafnium developed no color in the acid medium and only a very weak color in the neutral solution. Rhenium, which is reduced from the perrhenate with stannous chloride in a strong acid solution, developed a pale yellow color. Thorium, zirconium, and tungsten did not develop color with gallic acid.

The optimum pH, maximum, relative absorbance, and molar extinction coefficient for each metal gallate are summarized in Table 1.

Table 1. Comparison of absorbance data of metal gallates*

Element	pH	Wavelength, mu	Absorbance	Molar Extinction Coefficient
Niobium	7	340	0.372	10,300
	5	---	0	---
	4	---	0	---
Tantalum	7	340	0.433	12,000
	5	350	0.259	7,200
	4	390	0.115	3,200
Titanium	7	375	0.612	23,300
Vanadium	7.5	395 (min.)	0.174	9,600
	7.5	460	0.240	13,200
Iron (3)	7	520	0.361	10,000
Hafnium	7	385-400	0.014	---

*Conc. 3.62×10^{-5} molar except vanadium which is 1.81×10^{-5} M.

Tantalum chelates with gallic acid to produce a reasonably good color in acid solution, pH 4 and 5, with the maxima at 390 mu and 350 mu respectively. Since the other elements studied are colorless at this pH, except titanium and rhenium, it should be possible to develop a colorimetric procedure without prior separation of these elements. Titanium would have to be separated, but rhenium would be found rarely and only in special alloys.

LITERATURE CITED

1. Das-Gupta, P. N., *J. Indian Chem. Soc.*, 6, 855 (1929); *C. A.*, *24*, 1820 (1930).
2. Karyakin, Y. V., and Telezhnikova, P. M., *J. Applied Chem. (U.S.S.R)*, 19, 435, (1946); *C. A.*, 41, 1170 (1947).
3. Welcher, F. J., "Organic Analytical Reagents," Volume I, D. Van Nostrand Co., Inc., New York, 1948.

A Study of the Detection of Small Quantities of Acetophenetidin in Compound Preparations

George W. Hargreaves
Auburn University

Acetophenetidin or Phenacetin, chemically designated as p-acetamido-phenetole, for many years has been one of the most commonly used antipyretic-analgetics and ranks second only to aspirin with which it is commonly compounded. It is an ingredient of a variety of specialties and proprietary preparations and since the advent of television has gained considerable fame as one of the, and I quote, "combination of ingredients like a doctor's prescription," recommended for headaches.

Over a twenty-year period, many preparations containing Acetophenetidin have been submitted to the State Department of Toxicology for identification and frequently the specimens have consisted of only one or two tablets or capsules. The average quantity of Acetophenetidin in most commercial tablets and capsules is 150 mg. Thus, it is desirable to have a test which will work with 20-50 mg. and does not require separation of the Acetophenetidin from the other ingredients with which it is combined.

The official identification test which is commonly referred to as the "Oxidation Test" in such standard works as Autenrieth's *Detection of Poisons* (1) was first reported by E. Ritsert in 1889 (2).

This investigation was prompted by the frequent failure of the official Acetophenetidin test when examining small quantities of material for the State Department of Toxicology and when used by students in examining unknowns. The official USP test is as follows: "Boil about 200 mg. of Acetophenetidin for one minute with 1 ml. of hydrochloric acid, dilute with 10 ml. of water, cool, filter and add 1 drop of potassium dichromate T.S. to the filtrate; the mixture slowly develops a ruby-red color" (3). The official potassium dichromate test solution is a 7.5 per cent w/v solution. In applying this to smaller quantities the unreduced dichromate tends to mask the color reaction.

IMPROVED OXIDATION TEST

As the oxidizing agent originally used was 3 per cent chromic acid, the strength of the potassium dichromate was gradually reduced, using 10 mg. samples of Acetophenetidin, until a 1 per cent solution proved to be satisfactory. As the quantity of Acetophenetidin was decreased, it was found necessary to increase the time

of hydrolysis. The following conditions were found to be satisfactory for quantities of Acetophentidin ranging from 10-100 mg.: Add 2 ml. of concentrated hydrochloric acid to the specimen and immerse the test tube in a boiling waterbath for 5 minutes; add an equal volume of cold water, cool, filter, and to the filtrate add 1 drop of 1 per cent potassium dichromate; if Acetophenetidin is present, the mixture slowly develops a color varying from pale purple to ruby-red. If sufficient Acetophenetidin is present, a second drop of dichromate solution intensifies the color. In the presence of substances producing a highly colored solution add 50 mg. of activated charcoal before dilution.

OTHER MODIFICATIONS

Because of its quinone producing potential (4) lead peroxide was successfully substituted for potassium dichromate but it is less satisfactory because of its insolubility. Other investigators (1) have used chlorine water or sodium hypochlorite as the oxidizing agent. In another successful modification, 46 per cent hydrobromic acid was substituted for the hydrochloric.

IDENTIFICATION IN MIXTURES

Using fragments of tablets and portions of capsules estimated to contain from 20-50 mg. of Acetophenetidin, the modified oxidation test was successful in the presence of the following substances in the concentration in which they occur in commercial mixtures:

Alkaloids and related products

Atropine Sulfate
Belladonna Extract
Caffeine and Citrated Caffeine
Codeine Sulfate and Phosphate
Darvon (Dextropropoxyphene)
Desoxyephedrine
Dovers Powder (Ipecac and Opium)
Hyoscyamus Extract
Hyoscine
Hyoscyamine
Methlatropine Nitrate
Methylatropine Nitrate

Antihistamines

Chlorpheniramine (Chlor-Trimeton)
Methapyrilene (Histadyl)
Phenindamine (Thephorin)

Barbiturates

Amobarbital (Amytal)
Cyclopal (cyclopentenyl-allyl-barbituric acid)
Phenobarbital

Miscellaneous

Acetylsalicylic Acid (Aspirin)
Amphetamine (Benzedrine)
D-Amphetamine (Dexedrine)
Dipyrone (4-methylamino-antipyrine)
Gelsemium Extract
Monobromated Camphor
Phenolphthalein
Phenylsalicylate (Salol)
Salicylic Acid
Starch

A preparation which did not respond to this test was "Amidophen" which contains 227 mg. of aminopyrine (4-dimethylamino-antipyrine) to 65 mg. of Acetophenetidin. This is attributed to the strong reducing properties of aminopyrine. However, it was found by experiment that when equal quantities of aminopyrine and Acetophenetidin are present the test is successful. This also explains why the test was successful with the product "Axofor" which contains only 60 mg. of closely related 4-methylamino-antipyrine to 120 mg. of Acetophenetidin.

As yet no commercial combinations with the tranquilizers have been encountered, but experimentally the test was successfully obtained in the presence of Meprobamate (Miltown or Equanil). Preliminary experiments indicate that it will not be successful in the presence of the phenothiazine group of tranquilizers.

LITERATURE CITED

1. Autenrieth-Warren, *Detection of Poisons,* Blakiston, 1928, p. 128.
2. Ritsert, E., Pharm. Ztg. 1889, 546 through Proceedings of A. Ph. A. 38, 1890, p. 698.
3. United States Pharmacopoeia, 15th Revision, p. 17.
4. Hargreaves, G. W., J. A.Ph.A. XXV, 1936, p. 976.

Some Evidence in Alabama of Vadose Zone Cave Formation

Thomas W. Daniel, Jr.
Geological Survey of Alabama
University, Alabama

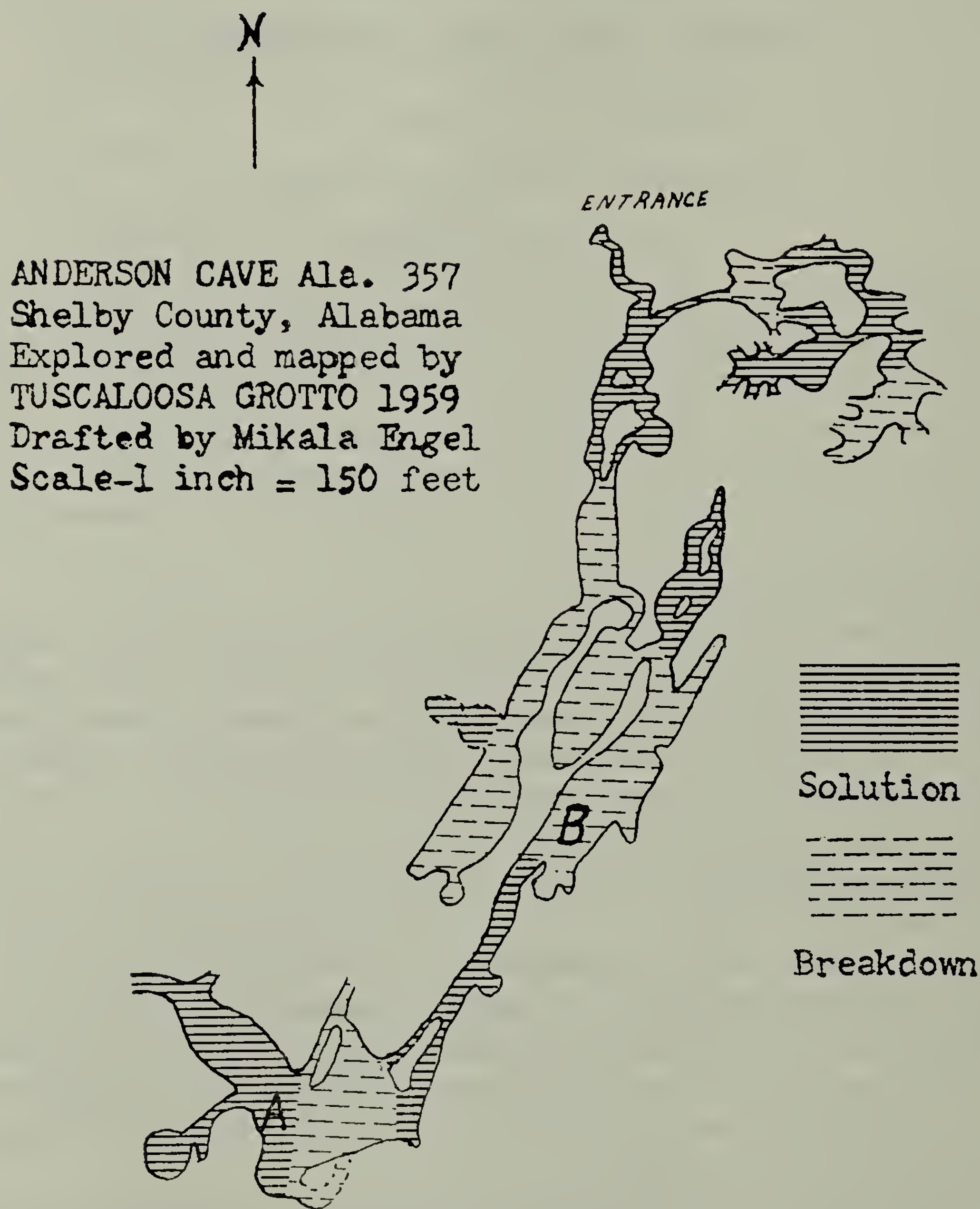
For many years there has been some disagreement among geologists concerning the origin of limestone caves. Three basic hypotheses, with variations, have been presented as to where most cave development occurs. These hypotheses are the vadose zone hypothesis which advocates most cave development above the water table, the lateral water table flow hypothesis, and the two-cycle hypothesis which advocates major solution in the slow-moving water below the water table.

Each cave has its own characteristics and has to be studied individually to determine its origin. There are caves representing each of the three basic hypotheses. However, there are some caves, parts of which indicate origin by all three hypotheses. Anderson Cave (Alabama Cave 357), located near Lake Purdy in Shelby County, is used as an example in this report.

Anderson Cave has formed in Ordovician limestone in the Little Oak Ridge. Little Oak Ridge is a northeast-southwest trending flank of an eroded anticline in the Cahaba Valley with beds dipping about 35-40 degrees southeast. There are several levels in the cave, with the lowest level representing what is believed to be the upper part of the phreatic zone. This may be seen on the map at A. The stream level is believed to be at the water table and the rest in the vadose zone.

The purpose of this report is to present some evidence in support of the hypothesis, which the writer believes, that most cave development in Anderson Cave is in the vadose zone.

It is generally agreed that solution of limestone in water and slightly acidic water is the most important factor in cave development. Rain water and melting snow become slightly acidic by obtaining carbon dioxide from the air and soil, and also by obtaining organic acids from the decaying organic matter on the surface. In limestone areas, that part which is not runoff seeps through the soil and enters the underlying limestone along joints and bedding planes. As it descends through these openings toward the water table it becomes partially, if not fully, saturated. Therefore, more



solution should occur in the upper portion of the limestone where the concentration of acid is greatest. Evidence of this may be observed in most limestone quarries. More and larger solution cavities are near the rim of the quarries and they decrease in size and number toward the bottom.

Solution and deposition in caves probably fluctuate to a great extent with periods of low and high rainfall. During periods of low rainfall, the velocity of the descending water decreases, which allows time for it to become saturated before it reaches the water table. If evaporation occurs during its descent, calcite is deposited in the form of speleothems. During periods of heavy rainfall, these

secondary deposits may dissolve and be redeposited at a lower level. This may be observed in most caves which contain numerous speleothems. Some geologists have used this as evidence that the cave is being filled or destroyed. This does not appear to be well founded since the calcite in speleothems had to come from above, thereby enlarging the upper passages. Neither does it take into consideration the large amount of limestone that was carried in solution to the water table and below.

During periods of high rainfall, probably much solution occurs in the vadose zone, but the velocity of the water may be great enough to prevent saturation. Therefore, unsaturated water would reach the phreatic zone. During these periods, much solution should take place below and at the water table due to the constant contact of the water and limestone and the lower velocity of the water.

Although related to solution, breakdown has been observed to be of major importance in enlarging caves in the vadose zone. Yet no great emphasis has been placed on it.

It has already been mentioned that infiltrating water works its way along bedding planes and joints. Solution of the limestone in these areas tends to carve the ceiling of caves into blocks of various sizes, which eventually fall. The fall may be only a fraction of an inch or it may be hundreds of feet. Whatever the case, the movement causes crushing and fracturing to take place, which allows more surface contact with water. It may be stated that the block has to have space in which to fall. This can be answered by the fact that solution had to take place first, whether in the vadose or phreatic zone, but when space is provided in which the block may fall, the increased surface contact accelerates solution. As more breakdown occurs, the ceiling grows higher and larger. When solution and breakdown cause the ceiling to become too thin for support of the overlying material, it caves in to form a doline or a sink. This indicates an upward growth of a ceiling rather than a downward growth of a floor.

In Anderson Cave, as the map shows, rooms containing rubble and breakdown are larger rooms than pure solution channels. In the Wonder Room (B on map) rubble has accumulated to about 15 feet high over most of the floor. The stream has dissolved a channel about 100 feet long beneath the breakdown. It then flows into a relatively pure solution channel which is about the same age as the Wonder Room. This channel through the breakdown is about one-third the size of the solution channel, yet it was evi-

dently formed much later. This illustrates how rapidly breakdown, with its increased surface area, goes into solution when compared to the original limestone.

It may be concluded that in Anderson Cave, solution channels are smaller in size than breakdown rooms. Therefore, from this evidence it may be theorized that caves with similar geological settings and conditions are vadose caves.

REFERENCES

1. Bretz, J. Harlan, Caves of Missouri: Missouri Geological Survey and Water Resources, vol. XXXIX, Second Series, 1956.
2. Davies, William E., Mechanics of Cavern Breakdown: National Speleological Society, Bull. 13, pp. 36-43, 1951.
3. Davis, William M., Origin of Limestone Caverns: Geological Society of America, vol. 41, No. 3, pp. 475-628, 1930.
4. Gardner, James H., Origin and Development of Limestone Caverns: Geological Society of America, vol. 46, No. 8, pp. 1255-1274, August, 1935.
5. Johnston, William Drumm, Jr., Ground Water in the Paleozoic Rocks of Northern Alabama: Geological Survey of Alabama, Special Report No. 16, Part I, pp. 34-41, 1933.
6. Longwell, Chester R., Knopf, Adolph and Flint, Richard F., Physical Geology: John Wiley and Sons, Inc., N. Y., Chapman and Hall, Ltd., London, pp. 134-139, 1949.
7. Meinzer, Oscar E., Hydrology, Physics of the Earth — IX: McGraw-Hill Book Co., Inc., New York and London, 1942.
8. Swinnerton, A. C., Origin of Limestone Caverns: Geological Society of America, Bull. 43, No. 3, pp. 663-694, 1932.
9. Vineyard, Jerry, The Reservoir Theory of Spring Flow: National Speleological Society, Bull. 20, pp. 46-50, Nov., 1958.

Application of Reversible Pump-Turbine Units in Hydroelectric Power Plants

A. E. Elkayar
Auburn University

INTRODUCTION

Pumped storage hydroelectric power plants have been extensively used in Europe, while few have been installed in the United States. In a great number of these plants, the turbine, pump, and electrical machine were installed as a unit, while in some other plants the pumps and turbines have separate electrical machines. Frequently the electrical machine is placed in the center, with the pump on one side of it and the turbine on the other. When the turbine is left permanently coupled, a clutch must be used on the pump so that the latter may remain stationary when the turbine is generating power. A unit so built is expensive and requires special gates for the draft tubes in order that the air in the turbines may be rarified when the pumps are running. Thus, the advantage of the dual-purpose hydraulic unit is obvious.

In order to flatten the peak load demand curves, we can store energy at times of low power demands. This storing of energy is done by the operation of the reversible pump-turbine. The new reversible pump-turbine is similar in appearance to the Francis type of hydraulic turbines and it has the same function as the Francis turbine. Moreover, the pump-turbine can perform as a pump when its direction of rotation is reversed. The function of this unit is to provide stored hydro-power by pumping water from a suction pond at a lower elevation to a storage lake at a higher elevation. The pump-turbine can then utilize this potential energy by developing power as a hydraulic turbine when the flow is reversed through the unit and passes from the storage reservoir to the suction reservoir. During recent years considerable study and experimental work have been devoted to the development of combination pumps and turbines with wicket gates which would be suitable for operation either as centrifugal pumps or as hydraulic turbines for peak load storage development.

ECONOMIC CONSIDERATIONS

At first glance, to pump water which consumes power in order to generate power at another time appears impractical. Today most of our electrical power is obtained from thermoelectrical systems.

Higher pressures and higher temperatures are constantly being applied in order to improve the performance of these units. Operating these units at a continuously high load factor becomes a problem because, in the average load curve, there are peaks and valleys that vary during a weekly cycle and seasonal load demands which change from month to month.

On many systems some of the steam units necessary to supply the load during working hours of the day must be shut down or put on standby at night or over weekends. After cooling during shutdowns, the steam units have to be warmed up again before loading them. Such a procedure of heating and cooling causes stress conditions that may damage the units. If, instead of shutting these units down, they are used to store energy at low demand loads, they can be operated more economically, maintenance can be reduced, and long unit life can be expected. Pumped storage hydroelectric power plants supply a means of storing this energy. By storing the off peak load which fills the valleys in the load cycle (Fig. 1), and supplying the additional energy required during heavy peak loads, pumped storage conserves energy. The pumped storage supplies the power for the top of the peaks and saves the equivalent amount of capacity load which would otherwise have to be supplied by additional steam or other units.

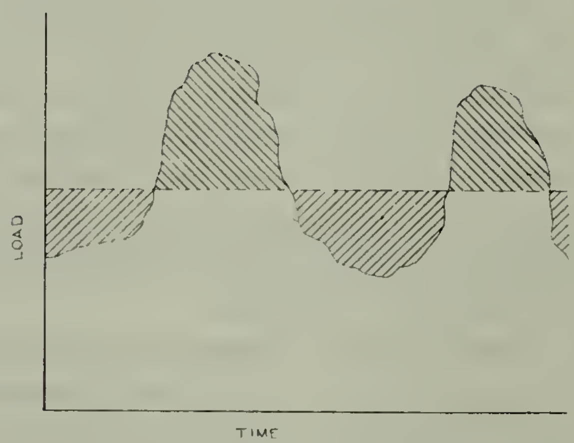


Fig. 1. Pumping and generating in accordance with variations in the load cycle.

Pumped storage can effectively use any surplus hydroelectric power. During rainy seasons, the water can be pumped into storage tanks in off peak hours to be used when the demand is at its peak or during dry seasons.

An excellent example of saving surplus water for use during peak demand periods is found at Niagara Falls. During the tourist season in the summer, a minimum of about 100,000 cubic feet per second should be allowed to flow over the falls during the daytime. However, at night, this quantity can be reduced to 50,000 cubic feet per second. Naturally, there is not much use for this additional 50,000 cubic feet per second at night. But if this amount is pumped into a reservoir during the night to be used for peak load periods during the

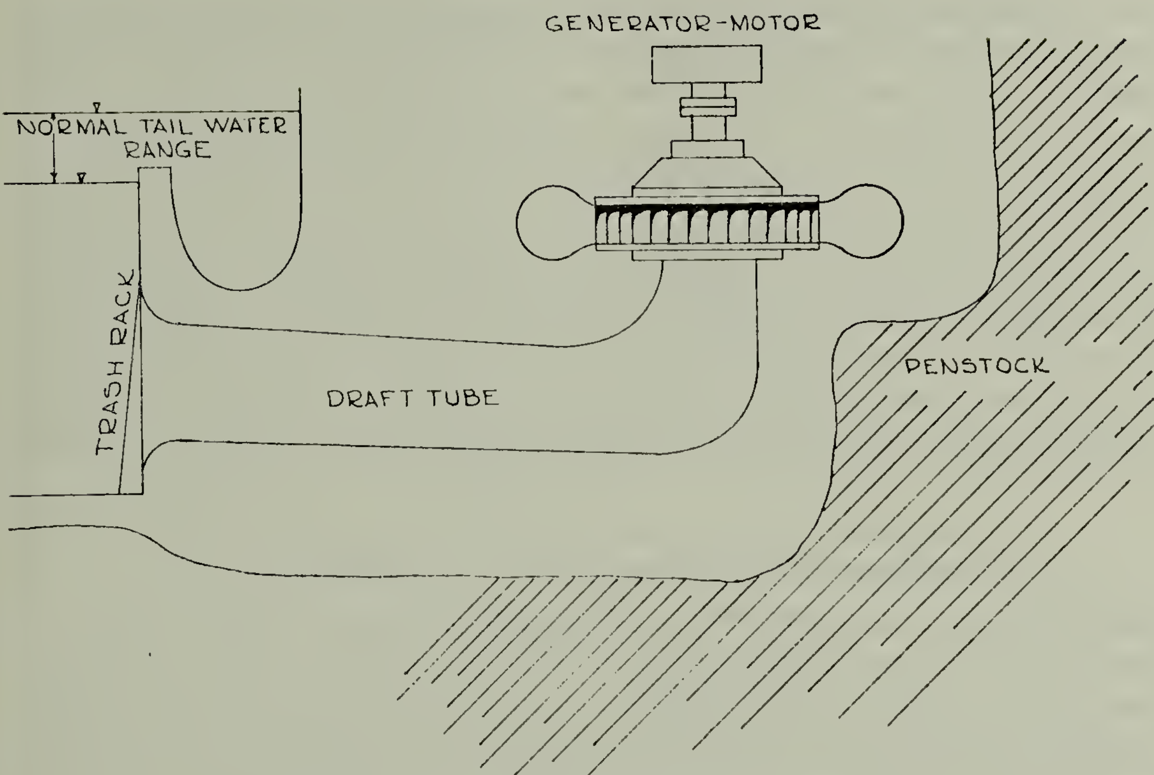


Fig. 2. The reversible pump-turbine.

day, then this hydroelectric energy is not wasted. To accomplish this, a reversible pump-turbine was built and it is functioning well.

DESCRIPTION AND OPERATION OF THE REVERSIBLE MACHINE

The reversible pump-turbine looks like the conventional Francis turbine. The impeller-runner shaft is connected to the generator. A spiral casing leads to the water and directs it into the penstock when pumping. The draft tube for discharging water into the tailrace when generating power works as a suction tube for pumping the water from the tailrace and guiding it into the impeller-runner (see Fig. 2). In modern types of pump-turbines, movable wicket gates around the impeller-runner are installed to control the flow of water in either direction. Units having wicket gates give a higher efficiency when pumping because, as the storage reservoir is filling, the head increases and the amount of water pumped decreases. As the quantity changes, the wicket gates can be adjusted to provide the proper flow for best efficiency. When generating power, wicket gates are used for starting and synchronizing the unit and then are opened wide to develop maximum power. If there are no wicket gates, a butterfly valve is provided and used for starting and synchronizing, then opened wide for generating or pumping, and closed for shutting down.

The value of the adjustable wicket gates for controlling the unit during turbine operation is so well established that the use of adjustable gates for pump-turbine units is almost a necessity whenever a close control of the power output during turbine operation is required. In designing such units, it is necessary to take into account the fact that the flow conditions at the gates during pump operation are such that increased and possibly pulsating forces on the gates can be expected which would not exist during turbine operation. This expectation is based on the fact that the accelerated flow through the gates during turbine operation is probably smoother and more stable than the outward flow during the pump operation. Experience gained with pump-turbine operation supports this reasoning.

In hydroelectric power plants where the units are operated as reversible machines, the necessity of using adjustable gates on the pump-turbine units can be eliminated if the power plant contains, besides the pump-turbine units, at least one water turbine of standard design which is not operated as a pump. In this case, the pump-turbine units can be used to carry the base load, while the load fluctuations are taken up by the standard control mechanism of the turbine. This arrangement is more likely to be acceptable since, for most hydroelectric storage plants, the turbine capacity has to be greater than the pump capacity in order to take care of peak loads.

A conventional Francis turbine does not make a good reversible pump-turbine. The runner designed for generating power does not make a good pump impeller. For pump-turbine units, the impeller is usually large in diameter, and the buckets are designed to give high efficiency for both flow directions.

A Francis turbine would have to be run at much higher speeds for pumping against the head than for generating power. Unstable flow while pumping would cause noise, and possible vibration and damage to the runner. In addition, a Francis turbine would have to be submerged much deeper below the tail water than would a reversible pump-turbine in order to avoid cavitation.

The reversible pump-turbine, like a centrifugal pump, must have its runner at least partly submerged in the water in order to avoid priming. When starting as a pump, the wicket gates are closed, the motor is started, and the unit is brought up to normal speed. When the full pressure is built up against the closed wicket gates, they are slowly opened to the proper gate opening (usually 80 to 90 per cent gate) and the water flows up the penstock into the storage reservoir. The wicket gates remain in this position until, with a rising head, the flow diminishes and a new gate position is necessary to

maintain maximum efficiency. At the end of the pumping cycle, the wicket gates are slowly closed to zero gate opening before the motor is disconnected from the line.

When starting the reversible machine as a turbine, the wicket gates are opened a small amount and the unit is brought to normal speed without any load. It is synchronized to the line before the circuit breaker is used. Then the wicket gates are adjusted to carry the load assigned to the unit. When shut down, the wicket gates are closed slowly, and when the unit reaches speed no load, the circuit breaker is opened to remove the unit from the line. Then the wicket gates are closed to zero gate and, after the unit slows down, brakes bring it to a stop.

PERFORMANCE OF THE REVERSIBLE MACHINE

The Newport News Shipbuilding and Dry Dock Company made a series of test performances of a combined pump-turbine model with wicket gates. The model used was a single suction machine of a relatively low specific speed. Its specific speed was 1750 rpm when running as a pump at highest efficiency and was about 25 rpm when running as a turbine at the best speed and at 95 per cent of its full gate power. Regarding the design of the model, its action as a pump was favored because of the critical conditions imposed by the deceleration in the water passages, as opposed to the acceleration in a turbine which is not as critical. According to research done in the field of pumps and turbines, it has been shown that the usual dimension proportions of pumps would result in satisfactory turbine performance, whereas the usual dimension proportions of turbines would not make satisfactory pumps. The most remarkable results of the model tests are seen when efficiency is plotted against unit speed for the model running as a pump and running as a turbine (Fig. 3). It can be noted that the best unit speed (Nu) for pump operation is 11 per cent higher than that for turbine operation. Thus, if the unit was operated as a turbine at a speed corresponding to a Nu of 105, which is the best Nu for turbine operation, it would have to run at 11 per cent higher speed when operated as a pump to obtain optimum performance under the same head.

When using the wicket-gate type pump-turbine, the characteristic test curves show the following advantages when working as a pump:

1. Smaller shut-off power required to bring pump up to speed.
2. Flatter efficiency-discharge curves, resulting in a higher efficiency over a wide range of discharge.

3. Steeper head curves, resulting in a smaller variation in discharge with head changes.
4. More discharge overload capacity at lower heads, unless affected by cavitation.
5. Better control of discharge at constant speed and head, since wicket gates replace a shut-off valve.
6. Smaller impeller diameter, about 95 per cent of the diameter of the volute type with shut-off valve.

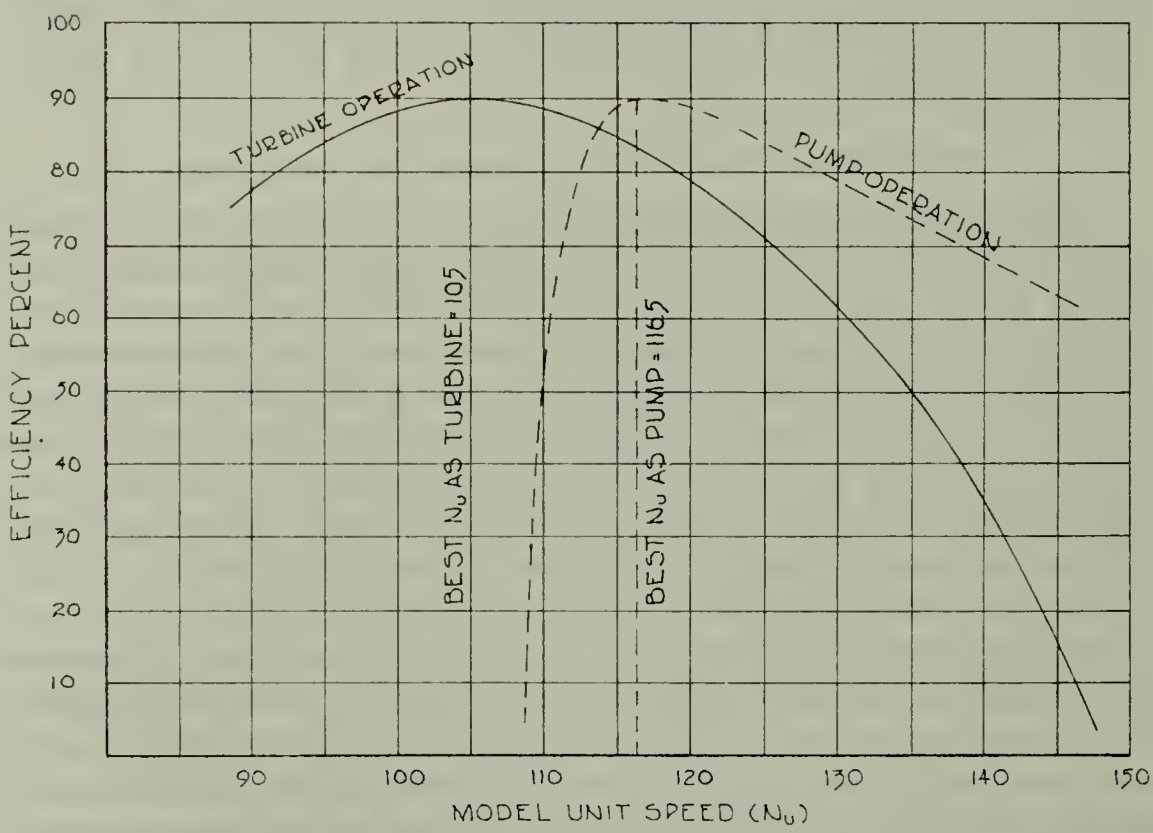


Fig. 3. Efficiency and speed of the test model pump-turbine operating as a turbine and operating as a pump.

Performance curves of a reversible pump-turbine working as a pump and as a turbine are shown in Figs. 4 and 5.

Better performance can be obtained if the reversible unit is operated at a lower speed for turbine operation than for pumping. The turbine runner characteristic may be such that more power and higher efficiencies are obtained by running the turbine at a lower speed than the pump (about 11 per cent lower, as shown in Fig. 3). The generator unit is more expensive to build for two-speed operation, and the gain in horsepower and efficiency must justify the additional cost.

At higher heads (500 to 1,000 feet) the head range will prob-

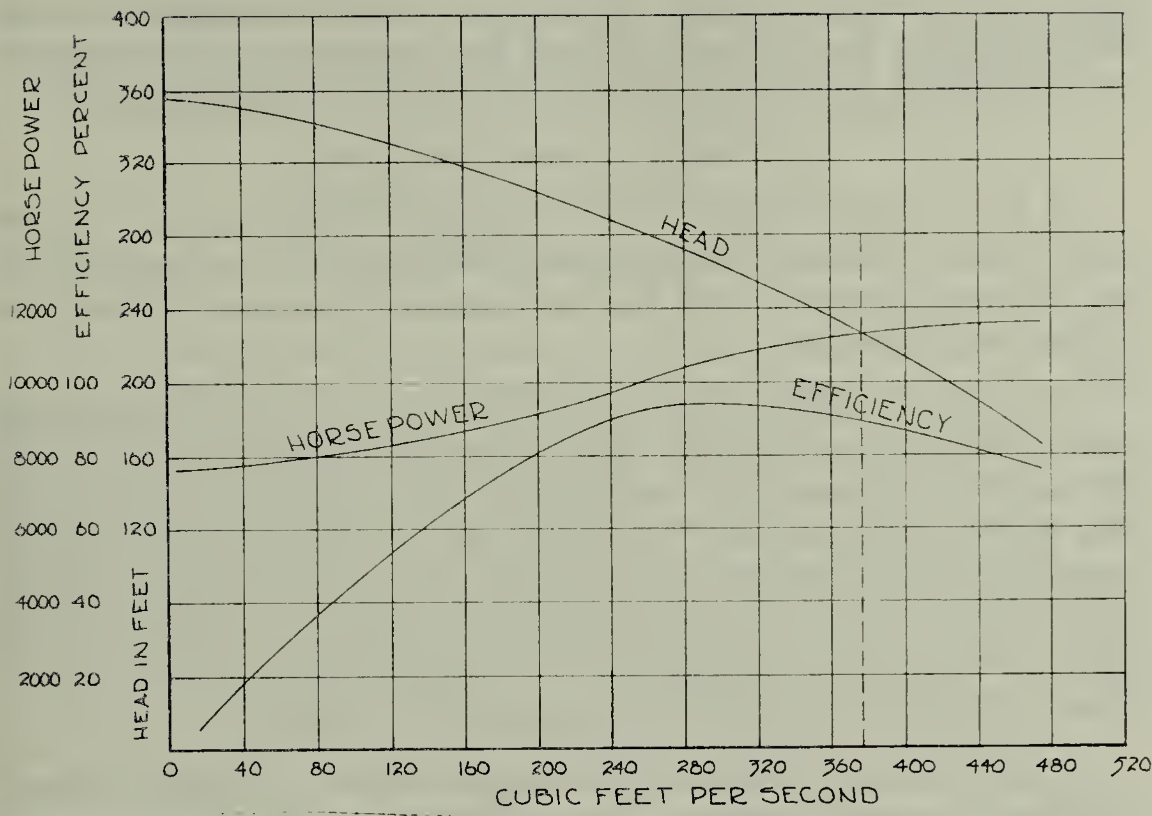


Fig. 4. Performance of reversible pump-turbine working as a pump.

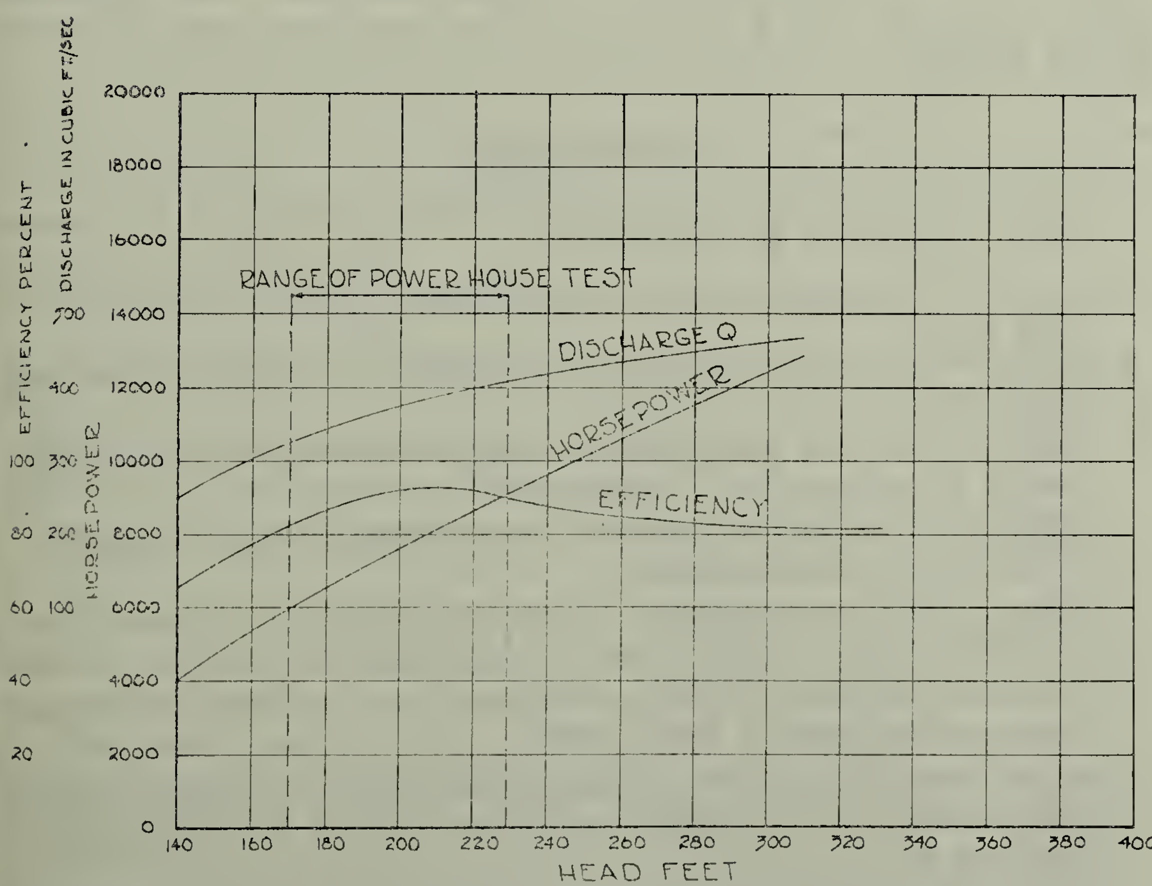


Fig. 5. Performance of reversible pump-turbine working as a turbine.

ably not be enough to make two speeds economical, while at heads below 150 feet, the characteristics of the runner are such that there is not sufficient gain in performance to justify the additional cost.

CAVITATION CONSIDERATIONS

A pump-turbine must have its impeller-runner full of water in order to start pumping. The distance that it has to be submerged below tail water depends upon the head and the discharge at the start of the pumping cycle.

In order to maintain proper flow through the impeller-runner when acting as a pump, there must be sufficient pressure head at the bottom or eye diameter of the impeller. This is usually called NPSH (net positive suction head). NSPH equals the atmospheric pressure in feet of water, minus the pressure at which water vaporizes at the temperature of the water, plus-minus the distance in feet from tail water to the bottom of the runner buckets (positive if tail water is above and negative if tail water is below the buckets).

Cavitation starts when the cavitation factor, NPSH/total head, is critical. To avoid cavitation, the cavitation factor used should be higher than the critical value. For high head units, the cavitation factor should be from 0.05 to 0.1; and for low heads units, it should be 0.3 and up.

REFERENCES

1. Allner, F. A., "Hydraulic Turbine and Pump Combined in a Single Unit," *Power,* Vol. 76, 1932, p. 266.
2. Annett, F., "Pumped Storage Hydro-Electric Plants," *Power,* Vol. 78, 1934, p. 20.
3. Jaske, F. E., "Pump-Turbines are Efficient," *Power Engineering,* May, 1952.
4. Maas, A., "Turbine and Pumps for Pump Fed Power Storage Plants," *Escher Wyss News,* Vol. 3, 1930, p. 52.
5. Mattern, D. H., "T.V.A. Installing Largest Pump Turbine at Hiwassee," *Electrical World,* July 5, 1954.
6. Power, "New Pump-Turbine Stimulates Interest in Pumped Storage Development," *Power Engineering,* July, 1950.
7. Spauhake, Wilhelm, "Problems of Modern Pump and Turbine Design," *Trans. ASME,* Vol. 56, 1934, p. 225.
8. Terry, R. V. and Jaske, F. E., "The Characteristic of a Combined Pump Turbine Model with Wicket Gates," *Trans. ASME,* Vol. 64, November, 1942, No. 8.
9. Wolff, N., "Pumped Storage Hydro Costs per K.W. are Competitive," *Electrical World,* May 8, 1948.

The Influence of Age, Race, and Educational Background on the Comparative Intelligence of Negro and White Children in a Semi-Rural County in Alabama*

Mabel Wilcoxson Thornton

Alabama College, Montevallo

The last few years have seen increasing interest in the problem of racial differences of intelligence. Scores made on Army Alpha and Beta intelligence tests administered during World War I revealed that the Negro recruits made markedly lower scores than did the white recruits (17). A significant difference based on geographical classification was noted at the time; northern Negroes appeared superior mentally to southern Negroes. In the ensuing years a substantial amount of literature dealing with the Negro in America, and in many cases pointing out the differences between the Negro and the white race, was published. Writers ran the gamut of beliefs, ranging from that of practically no difference in intelligence between the Negro and the white to that of a profound difference (17, 14).

Prior to 1931, Pintner (14) and his associates compiled formidable statistics based on the results of intelligence testing. They used the Binet, besides miscellaneous group tests (by which is meant the usual verbal type). In a comparison of Negro and white subjects by means of the Binet, they found the IQ of the Negroes consistently below that of the whites.

Strong (15), using the Goddard-Binet in making a comparison of 125 Negro and 225 white children (ages 5 to 15), found that the Negroes had lower mental ages than the whites. He had hoped to control the socio-economic factor by selecting his subjects from the children of mill workers of both races.

Negro college students, of course, test higher than Negroes in

*This paper is the author's master's thesis, done in 1957 in the Department of Psychology of Alabama College, Montevallo. The study was aided by a research grant from the Alabama Academy of Science.

The writer expresses special thanks to Dr. Katherine Vickery and Dr. Herbert Eber of the Psychology Department and to others who contributed to the carrying out of the study—W. W. Elliott, Superintendent of Shelby County Schools; John Deason, Principal of Thompson School; and the principals and teachers of both the Negro and white schools in which tests were given.

the elementary grades. However, even in colleges the Negro students achieve lower scores on tests than do white college students. Derrick (4) gives 103 as the median Binet IQ for 55 Negroes as compared with a median Binet of 112 for 75 whites.

Test scores of both the individually administered Binet and the group administered Army Alpha and Beta Tests of World War I revealed that the Negro troops achieved lower scores than white troops whether educated or uneducated. Data show the superiority of the white draftee over the Negro draftee and of the white officer over the Negro officer. The northern Negro scored higher than did the southern Negro (17).

The apparent influence of education on the scores made on the Army tests is summed up by Ferguson(5). After making "reasonable allowances" for differences in educational opportunities, he pointed out that while there is considerable overlapping of the two groups there exists a real racial difference.

A study by Peterson and Lanier(13) of the differences between Negroes residing in various sections of the country revealed that Negroes from Nashville, Tennessee, scored lower on the tests used than did Negroes from Chicago, Illinois. Negroes from Chicago in turn scored lower than did those from New York City. In the same study it was found that there was practically no difference between New York Negroes and New York whites living in the same neighborhood. The authors felt that the severe struggle for existence in an urban area had probably thrown together in the same neighborhood a better-class Negro and a lower-class white group, resulting in apparent equality between the races.

In a comparative study of Army tests scores and the school grades of over 2,000 Negro and 2,100 white World War II inductees, Fulk and Harrell(6) found that the mean scores of the whites exceeded those of the Negroes when comparative groups were matched by educational level as represented by "last grade completed." There were no data to indicate differences due to regional origin, nor were there criteria by which the quality of schools might be ascertained.

Telford and Peterson(16) used both individual and group tests in a study of practically pure-blooded Negroes on St. Helena Island. They compared results of these tests with the results of the same tests given to both white and Negro children of Nashville. Results of group tests showed differences that were felt to be due, to a large extent, to unequal training and background of the children. The individual tests showed that in *Rational Learning* there is a reliable difference between the median of Island Negroes and that of Nash-

ville whites of equal age. There is a reliable but smaller difference between Island Negroes and Nashville Negroes of the same age. The larger differences found on performance tests between racial medians were felt to be due largely to cultural factors. The authors did not pretend to measure pure innate differences in any test.

Marked changes in viewpoint have been advanced by both psychologists and sociologists in this field during the last few years. The validity of tests used in the experiments was questioned. Canady (3) pointed out inequalities in testing situations which included the wide environmental and cultural differences of the two races, social and economic opportunities available to both races, and the social heritage of the Negro as compared with that of the whites. Other factors in this study that placed the Negro at a disadvantage appeared to be failure of the experimenter to establish rapport with Negro children, speed factors which handicap Negro children, difference in motivation, inaccuracy and ambiguity of measuring instruments, lack of a satisfactory definition of race, and difficulties of finding representative samples. As a result of these and other factors, many students of the subject changed their point of view.

C. C. Brigham (2) had concluded from a study of the results of tests made during World War I that whites are innately superior to Negroes in intelligence. Later, spurred by criticisms of psychologists who pointed out that environment probably influences scores made on tests, and that the tests used failed to measure native ability, Brigham withdrew from his original position. He stated that the studies, which had appeared to demonstrate racial differences by means of intelligence tests, were not valid.

Tests which had been held to be "culture free" were also studied. Goodenough (8) had concluded that her *Draw-a-Man Test* indicated superior intelligence of the white race. In 1950 she "apologized" for her conclusion and declared that mere freedom from verbal requirements is not a reliable criterion for a culture-free test.

Another question growing out of increased sophistication about intelligence tests is whether the superiority of the northern Negro was due to better educational and economic opportunities, or whether there had been a migration of superior Negroes from the South to the North. Peterson and Lanier (13) had implied support of this last conclusion.

Klineberg (10) made a direct attack on this problem, apparently showing that there was no selective migration. He found that the school records of migrants were in no way superior to those of nonmigrants who remained in the South. On the other hand there seemed

to be a positive indication of improvement shown by intelligence test scores of former southern Negroes who had moved to New York, the improvement being clearly related to the length of time that the children had lived in that city. The study assumes that New York provides a superior environment. It must be noted that Negro children did not quite "catch up" to the norms of the white children; however, one would hardly say that the environment was the same in every way.

Lee (11) made an investigation in Philadelphia in which he attempted to check the hypothesis that test scores of southern Negroes rise as length of residence in Philadelphia increases. He administered tests to the same individuals over a period of years, and in some instances obtained scores from the southern schools which the children had originally attended. He concluded that there was a significant trend upward in intelligence ratings of southern Negroes as their length of residence in Philadelphia increased.

Looking over the evidence as presented, it appears that as we find them Negroes are inferior to whites when compared by intelligence test scores. Many of the authors feel that they have presented evidence that some or all of this difference is due to environmental factors.

DESIGN OF INVESTIGATION

The purpose of this study is to investigate the degree of importance of such environmental factors as are present, by measuring their effects on Negro and white children over a period of time, in comparable school situations. It appeared to the writer that if the results of past experiments are applicable, commonly used intelligence tests should show Negro children significantly inferior to whites of the same age and grade, regardless of the age at which the comparison is made.

Furthermore, if southern schools in general are of as poor quality as is usually believed, then commonly used tests should demonstrate that the older children of our samples (those in the higher grade) are significantly inferior to the younger ones (those in the lower grade) regardless of race, when scores of both grades are compared with corresponding national norms.

Finally, if the comparatively poorer environment of Negro children is responsible for a substantial part of their inferiority, the commonly used intelligence tests should show Negro children becoming comparatively more inferior with increasing age than do their white counterparts.

PROCEDURE

Selection of subjects. The hypotheses stated above require testing of both Negro and white children, hereafter designated as N and W, respectively, in at least two grade levels. For the purpose of this investigation the two grades chosen were three and six, designated by the numbers 3 and 6. The study assumes that three years represents a sufficient period of time for temporal effects to become noticeable. Specifically, 3 is the lowest grade at which group tests can be administered with any degree of validity; grade 6 is the highest level at which a test identical to that of grade 3 could be used.

The factor of race is obviously differentiated by selecting N and W children from their respective segregated, but adjacent, schools.

Selection of tests. The Raven Progressive Matrices (1947), a non-verbal test which minimizes educational training, was selected. This test was constructed on the assumption of Spearman's principles of neogenesis, and seems to provide a means for comparing people with respect to their capacities of observation and clear thinking. The scale is intended to cover the whole range of intellectual development, from the level at which a child is able to grasp the idea of finding a missing part of a pattern, to the more difficult level of assessing a person's ability to form comparisons and to reason by analogy. The test has a retest reliability varying, with age, from 0.83 to 0.93. It correlates 0.83 with the Terman-Binet and has been found to have a G saturation of 0.82. It appears promising in the comparative study of N and W intelligence factors. The test was administered by means of colored film slides. This method was used in a study (7) made in Rochester, Minnesota, where it was found that group and individually administered tests were comparable and the group tests appeared suitable for amassing data.

The Henmon-Nelson Test of Mental Ability, Form C, a verbal test requiring educational training, was selected as a second component of the battery. This test yields a single global score, an overall estimate of general intelligence. It appears to measure scholastic aptitude, particularly at the lower levels, and so is suitable for use in this study. The norms compare favorably with other tests such as the California Test of Mental Maturity and the Dominion Group Test of Learning Capacity.

A third component of the battery was chosen to emphasize educational training. The Los Angeles Reading Test, Form 2, was used since the grade span of this test includes both grade 3 and grade 6.

Although the material in the test is somewhat out of date, it appeared to be equally valid for N and W children.

All tests were administered within a period of three weeks, after the children had had opportunity to be in school for about two months. Tests were given during the morning hours by the same team of administrators, with minor exceptions.

The hypotheses will now be restated in terms specific to this investigation:

1. Test scores of N children will be significantly inferior to those of W children, regardless of age.

2. Regardless of race, scores made by children in grade 6 will be significantly inferior to those made by children in grade 3, when said scores are compared with national norms.

3. The scores of N children of grade 6 will be even more inferior than would be expected on the basis of simple summation of hypotheses 1 and 2.

Statistical analysis. Analysis of variance as described by McNemar (12), for example, appears to be the method of choice for investigating the hypotheses of this study. The technique permits simultaneous evaluation of the factors of race, of age, and of the specific interactions of the factors as described in Hypothesis 3. Significance of results is evaluated by standards set by Fisher and Yates, Table V, as used by McNemar.

Local situations made it impossible to obtain equal numbers in each group tested. In order not to make arbitrary selections, tests were given to all children who were present on the day of testing. Table 1 shows the number of subjects used in the analysis. Subjects who were significantly over-age (two or more years for their grade) were dropped. The scores made by these children were felt to be atypical. Social promotions had been made in all of the schools if a child had taken a grade twice. Of the cases dropped, about 7 percent were W children, and 12 percent were N children.

Table 1. Number of subjects used.

Grade	W	N
3	156	59
6	139	46

It will be noted that there are more W than N subjects in both grades. This is a reflection of (a) the population ratio of about three

W children to one N child enrolled in the rural schools of this area, and (b) the higher rate of absenteeism found among N children. It was not possible to control the factor of absenteeism, but it was held not to be a selective factor in that absenteeism is quite prevalent among N children, regardless of the intelligence level. This statement was made by several of the Negro principals and teachers. The large number of cases seemed to justify proceeding by proration, and analysis was made as if equal numbers were attained in each cell.

Test scores were converted graphically to a standard score with a mean of 50 and a standard deviation of 8.0. This standard score was derived from national norms. Analysis of the data obtained from the present study reveals that by comparison N subjects were inferior to the W subjects. Table 2 shows the mean and sigma in standard scores on all tests given.

Table 2. Means* and sigmas* on tests given N and W children based on total number of subjects used.

Test	W 3		N 3	
	Mean	Sigma	Mean	Sigma
Raven	46.1	10.9	39.0	9.0
Henmon-Nelson	48.9	7.0	43.5	4.8
Los Angeles Reading	45.6	10.2	38.0	5.2
	W 6		N6	
Raven	46.8	8.9	34.8	9.8
Henmon-Nelson	48.9	7.0	40.3	4.6
Los Angeles Reading	45.6	10.2	31.2	10.2

*Means and sigmas are to be compared to a national norm of 50 and a standard deviation of 8.0.

These data indicate that test scores made by W children were consistently higher than the test scores made by N children, in confirmation of Hypothesis 1. A comparison of the means scores of both

grades of W children reveals that when compared with national norms the scores of children in grade 6 are not significantly inferior to those of grade 3. The scores of N children grade 6 appear inferior to those of W children at both grade 3 and grade 6 levels, but they are also inferior to scores made by N children in grade 3.

The levels of significance of variance in the test results are given in Table 3.

Table 3. Direction of differences, variance, and level of significance found by analysis of test results.

Factor	Direction of differences	F	Level of significance
Race (Hyp. 1)	$N<W$	44.39	$p<.001$
Age (Hyp. 2)	$6<3$	2.91	$.05<p<.10$
Race-age interaction (Hyp. 3)	$6\ N< \left\} \begin{matrix} W\ 3 \\ W\ 6 \\ N\ 3 \end{matrix} \right.$	2.87	$.05<p<.10$

Analysis of the data obtained from the present study reveals that on every point of comparison the N subjects are inferior to the W subjects. Hypothesis 1 is confirmed at a level considerably in excess of commonly accepted standards. Test scores of the N children were significantly lower than those of the W children, regardless of age, with p less than .001.

Hypothesis 2 is not confirmed. Although the direction of difference indicates that when expressed in standard score units, scores made by grade 6, both N and W, are lower than scores made by grade 3, the variance ratio is not significant. This does not mean that these differences do not exist but only that they were not adequately demonstrated in this study.

The level of significance of the race-age interaction does not confirm Hypothesis 3. There appears to be a tendency for N children to grow increasingly more inferior between grades 3 and 6 but again the differences are not of great enough significance to draw any conclusions.

DISCUSSION

Previous studies of the comparative intelligence of Negro and

white children have indicated that the inferior scores made by Negro children on intelligence tests were due in a significant measure to environmental factors. It is common knowledge that, on the average, living standards of Negroes in the South are lower than those of whites living in the same areas. The environment may in some cases be similar, but it could not be judged to be the same.

The physical equipment of all Negro schools visited during the study appeared to be inferior to that of the adjacent white schools. The Negro schools were located on sites somewhat removed from arterial highways and railway lines, while, on the other hand, the white schools visited were situated in very close proximity to busy highways and railways. It would seem that this might have some bearing on learning conditions in the respective schools. In none of the Negro schools visited were there indoor toilets, although this is not true of all Negro schools in the county. The library and play equipment in the Negro schools were limited as compared with those of the white schools. All schools in the county, both Negro and white, have electricity, and all of the schools participate in the federal lunchroom program.

School records show that the attendance of Negro children is extremely irregular. Absenteeism plays an important part in delaying the educational training of children.

Scores made by children in the present study, although somewhat lower than the national norm, indicate that southern white schools are not as inferior as they are sometimes reputed to be. White children in grade 6 scored lower than did white children in grade 3 when compared with national norms, but the difference is not great enough to be significant.

The significantly inferior scores of Negro children in grade 6 of this study are in line with findings of other studies of the comparative intelligence of Negro and white children. Poor environment may be considered as an important factor which results in lower scores made by Negro children. As we find them Negro children make lower scores on intelligence tests than do white children. They also score lower on tests involving school achievement.

SUMMARY

1. A historical review of studies of the comparative intelligence of Negroes and whites was made.

2. Commonly used intelligence tests were administered to Negro and white children in grades 3 and 6 from segregated, but adjacent, Negro and white schools in a semi-rural southern county.

3. The method used to evaluate the significance of results was *analysis of variance.*

4. The findings indicate that (a) test scores of Negro children are inferior to those of white children, regardless of age, (b) test scores of sixth grade children are to a slight but not significant degree lower than those of third grade children when compared with national norms, and (c) the test scores of Negro children are to a slight but not significant degree more inferior as age increases.

REFERENCES

1. Anatasi, Anne. *Differential Psychology.* New York: The MacMillan Company, 1937.
2. Brigham, C. C. Intelligence tests of immigrant groups. *Psychol. Rev.* 1930, 134:158-165.
3. Canady, H. G. The methodology and interpretation of Negro-white mental testing. *Sch. and Soc.* 1942. 55:569-575.
4. Derrick, S. M. A comparative study of the intelligence of seventy-five white and fifty-five colored college students by the Stanford Revision and Binet-Simon Scale. *J. Appl. Psychol.* 1930, 4:316-329.
5. Ferguson, G. O. The psychology of the Negro. *Arch. Psychol.* 1916, No. 36.
6. Fulk, Byron E. and Harrell, Thomas W. Negro-white Army test scores and last school grade. *J. Appl. Psychol.* 1952, 36:34-35.
7. Green, M. W. and Ewert, J. C. Normative data on progressive matrices (1947). *J. Consult. Psychol.* 1955, 19:139-142.
8. Goodenough, Florence, and Morris, C. B. Studies in the psychology of children's drawings. *Psychol. Bul.* 1950, 47:369-433.
9. Hammer, E. F. Comparison of the performance of Negro children and adolescents on two tests of intelligence, and an emergency scale. *J. Gen. Psychol.* 1955, 84:85-93.
10. Klineberg, O. *Social Psychology.* New York: Henry Holt and Company, 1954.
11. Lee, E. S. Negro intelligence and selective migration: a Philadelphia test of the Klineberg hypothesis. *Am. Sociol. Rev.* 1951, 16:227-233.
12. McNemar, Quinn. *Psychological Statistics.* New York: John Wiley and Sons, Inc. 1949.
13. Peterson, J. and Lanier, L. H. Studies in the comparative abilities of whites and Negroes. *Mental Meas. Monog.* 1929, No. 5.
14. Pintner, R. *Intelligence Testing.* New York: Henry Holt and Company, 1931.
15. Strong, A. C. Three hundred fifty white and colored children measured by the Binet-Simon Measuring Scale of Intelligence. *Ped. Sem.* 1913, 20:485-515.
16. Telford, C. W. and Peterson, J. Results of group and of individual tests applied to practically pure-blooded Negro children on St. Helena Island. *J. Comp. Psychol.* 1930, 11:115-124.
17. Yerkes, R. N. and Yoakum, C. *Army Mental Tests.* New York: Henry Holt and Company, 1920.

Pharmacy Schools in Alabama*

Emmett B. Carmichael

University of Alabama Medical Center, Birmingham

The history of pharmacy schools in Alabama parallels somewhat the industrial and scientific development in our state as well as advances in medicine.

The annual announcement of the Medical College of Alabama, Mobile, for the session 1882-83 carried the following:

> To meet a want which is making itself more and more felt, the faculty have established a Chair of Pharmacy in connection with the college and to that end have secured the services of a practical pharmaceutist who is a regular graduate in that branch. Students taking this course will be required to attend the regular lectures on chemistry and materia medica.

Two students received the degree Graduate in Pharmacy on March 20, 1884, at the commencement which was held in Temperance Hall.

The pharmacy course, as the Department of Pharmacy, was continued after the University of Alabama adopted the Medical College of Alabama in 1897. It was a two-year course. The first-year class usually had about 15 students and the second-year class usually had about 10 students. The Department of Pharmacy remained an integral part of the University until the Medical College of Alabama closed in 1920.

When the Birmingham Medical College was organized in 1893, it provided instruction in dentistry and pharmacy. The pharmacy faculty included many of the same individuals who taught in both the Medical College and the Dental College. Two of those teachers are still living. One, Dr. E. P. Hogan, was Associate Professor of Gynecology and Abdominal Surgery in the Graduate School of Medicine, Birmingham. He also served as secretary of both the Dental College and the Department of Pharmacy and Pharmaceutical Chemistry. The other, Dr. J. D. Heacock, was Professor of Dental Jurisprudence and Hygiene in the Dental College and Professor of Hygiene and Pharmaceutical Jurisprudence in the Department of Pharmacy. In 1910, Dr. A. Richard Bliss was called as Chairman of the Department of Pharmacy. The catalogue for the

---

*Read at the Auburn meeting of the Academy, March 13, 1959.

Department of Pharmacy for 1913-14 listed three courses of instruction which led to the following degrees: (a) Graduate in Pharmacy, Ph.G.; (b) Pharmaceutical Chemist, Ph.C.; and (c) Doctor of Pharmacy, Phm.D. The Department continued until the Birmingham Medical, Dental and Pharmaceutical College closed in 1915.

It is interesting to note that the Medical College staff, which in part helped with instruction in both the Dental and Pharmacy Colleges, was also largely included on the staff of the Graduate School of Medicine, Birmingham, as of September 1, 1913. The Graduate School of Medicine was under the auspices of the University of Alabama, Tuscaloosa, until 1915 when all branches of the Birmingham operation ceased to function.

Instruction in pharmacy at the Alabama Polytechnic Institute at Auburn was authorized by the Board of Trustees in 1885. The authorizing statement reads in part, "A special course of instruction in pharmacy . . . to qualify young men, by systematic work in chemistry and other sciences, to become practical pharmacists and chemical manufacturers." This preparatory course instructed students in alkaloidal assay and toxicology but did not prepare them to qualify as pharmacists.

In 1895, President W. LeRoy Broun decided to strengthen the pharmacy course, so he hired Mr. Emerson R. Miller who had received four degrees in pharmacy at the University of Michigan. A junior class in pharmacy was organized. This constituted the fifth course of instruction introduced into the curriculum at the Alabama Polytechnic Institute, Auburn. The student received the Bachelor of Science degree in Pharmacy following the four-year course.

In 1899, Auburn added a two-year curriculum for those students who were unable to pursue the four-year degree course. Upon completion of the two-year course, the student was awarded a certificate as a graduate pharmacist. In 1924, the two-year course was discontinued and a three-year course was offered which led to the degree of pharmaceutical chemist. This three-year course was discontinued in 1932, in order to comply with the requirements of the American Association of Colleges of Pharmacy. Since that date, the Alabama Polytechnic Institute, now Auburn University, has offered a four-year course leading to the degree of Bachelor of Science in Pharmacy.

Dr. Miller, who came to Auburn in 1895, resigned in 1913 as Professor of Pharmaceutical Chemistry. Another graduate of Michi-

gan, Mr. Lynn Stanford Blake, was hired to replace him. Professor Blake was appointed Dean of the School of Pharmacy in 1941 and is still in charge.* Mr. B. O. Shiflett, who had operated his own school of pharmacy in Birmingham from 1919 to 1927, joined the staff in January, 1947, as Assistant Professor.

The first Auburn graduate in pharmacy, Mr. S. L. Coleman, received the Ph.C. degree in 1896 and then entered Tulane where he earned the M.D. degree. The enrollment reached 27 students in the second year of operation and gradually increased to 55 students by 1910. The all-time high was reached in 1949, following World War II, when 329 students enrolled. The enrollment has become stablized and is of the order of 250 students per year. More than 1,100 have received degrees from the School of Pharmacy at Auburn. There are approximately 800 living alumni, who are filling positions in every branch of the drug field. A good number of the alumni have entered the field of medicine.

The knowledge which is available in each of the various pharmaceutical subjects is quite extensive, more than an undergraduate curriculum should include. Auburn's School has found it necessary to set up five divisions: Pharmacy, Pharmaceutical Chemistry, Pharmacology, Pharmacognosy, and Pharmaceutical Economics. Post-graduate work leading to the Master of Science degree is offered in the first four divisions. The Pharmacy faculty has attempted to foster in students the desire for continued professional study.

The Department of Pharmacy, and later the School of Pharmacy, at Auburn has been housed in several buildings during the more than 60 years of its service. It moved into new quarters, Miller Hall, in 1952. With the new facilities, a strong faculty, and a good enrollment, the School of Pharmacy at Auburn University looks forward to more improvements and to being able to render still greater services to Alabama and the nation.

One of the alumni of Auburn's School of Pharmacy, Mr. Barry O'Neal Shiflett, who had made the highest grade on the Alabama State Board Examination in 1917, organized a private school of pharmacy in Birmingham in 1919: the B. O. Shiflett School of Pharmacy. The school graduated its first class early in 1921. It offered two four-month courses per year. The school catered to individuals who were working in local drug stores and who had either not taken a regular college course in pharmacy or had not

*Deceased June 23, 1959.

become registered pharmacists. The catalogue stated that the course was not to be compared with schools whose courses were merely quiz courses, but that daily laboratory work was a most important asset in the course. The following statement in the catalogue about the course is of interest: "Its purpose is to really teach pharmacy in a single, instructive and entertaining manner, through experiments, lectures and demonstrations." This school filled more than a local need — students came from many states north of the Mason and Dixon Line. Many of the local drug clerks requested night classes, which were provided. A correspondence course was offered also. But Mr. Shiflett advised everyone who could do so, even at a sacrifice to his business, to come to the school and take the regular course with all of the laboratory facilities and personal help that he would receive. The records of the graduates were so wonderful that as early as 1923 an absolute money-back guarantee was made that graduates would pass the State Board Examination, if they met the requirements of the Alabama State Pharmacy Law otherwise, such as being 21 years of age, having two years of high school, etc. However, the law which became operative on January 1, 1927, required that pharmacy students complete a three-year course in pharmacy plus one year of practical experience in drug store work. This law forced Mr. Shiflett to close his school in December, 1926.

Previous to closing his school of pharmacy, he consulted with Dr. Guy E. Snavely, President of Birmingham-Southern College, Birmingham, who was making plans to establish a department of pharmacy at that institution. The plans were crystallized and a department was opened on January 31, 1927. Dr. W. C. Jones, M.D., was appointed head of the Department of Pharmacy and Professor of Pharmacology. Mr. B. O. Shiflett was appointed as Instructor of Pharmacy and was to have charge of all the strictly pharmacy courses.

On hiring Mr. Shiflett to be the Instructor in Pharmacy at Birmingham-Southern College, Dr. Snavely told the press, "His qualities as an instructor are shown in the record in his own school in Birmingham. Mr. Shiflett's students made the highest marks in 11 out of 14 of the last State Board Examinations."

Mr. Shiflett established a new journal, The Birmingham Bulletin of Pharmacy, which he edited and published under sponsorship of the Department of Pharmacy, Birmingham-Southern College. The publication was discontinued after several issues, due to rising costs and due to the fact that Birmingham-Southern

College failed to support the project financially.

The Department of Pharmacy operated for two school years and then, owing to a lack of funds, it was discontinued. On September 7, 1928, President Snavely wrote Mr. Shiflett a letter in which he stated that Birmingham-Southern College had decided to abandon the plan of developing a pharmacy department. Mr. Shiflett continued on as a science student and soon became associated with Howard College of Birmingham.

An Act of the Alabama State Legislature in 1931 made it possible for those persons who were holding assistant pharmacy licenses in Alabama and those who had been engaged in the drug business for the past ten years to take the examination conducted by the Alabama State Board of Pharmacy and, if successful, to be issued a license to practice pharmacy. The following excerpt from the above Act tells the story:

> And Provide Further, that all persons who hold Assistant Pharmacy Licenses in Alabama shall have the privilege of taking a pharmacist examination before the State Board of Pharmacy on or before the 1st day of July, 1932, and if successful shall be issued a pharmacist license. And Provided Further, that any person of good moral character who now is, and has been, actively and continuously engaged in the drug business for the past ten (10) years in a town of less than two thousand (2,000) population may appear before the State Board of Pharmacy and take a limited examination; and, if successful, shall receive a limited license which shall entitle him or her to practice pharmacy in such town. And Provided Further, that such limited license shall become null and void immediately when the owner thereof sells his or her business, or for any other reason discontinues the practice of pharmacy in his or her present locality. Any person who can qualify under this provision of Section 7 must appear before the Board on or before July 1, 1932, for examination. And Provided Further, that all persons or good moral character who now have been actively and continuously engaged in the drug business as an owner or clerk and doing prescription work under the supervision of a registered pharmacist for the past ten years or who will between the date of approval of this Act by the Governor and March the first, 1932, have been actively and continuously engaged in the drug business as an owner or clerk and doing prescription work under the supervision of a registered pharmacist for ten years shall have the privilege of taking a pharmacist examination before the State Board of Pharmacy on or before the 1st day of July, 1932, to be licensed as a pharmacist, and if successful shall be issued a pharmacist license.

The 1931 Pharmacy Law created a demand for a refresher course or a quick course in pharmacy. Mr. Shiflett reopened his

school and taught not only daytime classes but also ran night classes for those individuals who were employed during the daytime hours in local drug stores.

The law has not been relaxed since July 1, 1932, and standards have been strengthened since then.

In response to many requests by individuals and societies, the Administration of Howard College, Birmingham, decided to add a department of pharmacy. The report of the Trustees of Howard College to the Alabama Baptist State Convention on November 16, 1926, stated that the Department of Pharmacy would be established as of January 31, 1927. The new law which became operative on January 1, 1927, was attractive to the Howard College Administration since it required that pharmacy students complete a three-year course in pharmacy plus one year of practical experience in drug store work. There were more than 200 drugstores in Birmingham at that time, and they could be used to obtain practical experience. Also, as a result of the law, Alabama Polytechnic Institute's Department of Pharmacy, which was the only School of Pharmacy in Alabama, could not accommodate all of the needed pharmacy students due to the lack of drug stores in the surrounding community. The Birmingham Pharmaceutical Association unanimously endorsed the Department of Pharmacy at Howard College, and President Hal E. Ducan of the Alabama Pharmaceutical Association stated in a letter that, "We have always warmly supported Auburn in this work, and we will support Howard in the same measure."

The Howard College Bulletin, December, 1926, reported Dr. James L. Brakefield to be Head of the Department of Biology and Pharmacy. Mr. W. R. Little, Ph.C., was listed as Professor of Pharmacy. The Howard College Bulletin, April, 1929, mentioned B. O. Shiflett as Instructor in Pharmacy. But it seems that after four years, pharmacy had ceased to be offered at Howard. No one was listed in the 1931 Bulletin as a teacher of pharmacy, and a Department of Pharmacy per se was omitted. Pharmacy courses as such had been deleted from the 1931 Bulletin.

Later, a renewed interest in the Department of Pharmacy at Howard College was evidenced by the fact that a Pharmacy School was authorized in 1932, and two instructors in Pharmacy were hired. First-year classes began in September of that year. The 1933 Catalogue listed several courses in pharmacy. The pharmacy faculty was strengthened when Dr. A. Richard Bliss, Jr., joined the staff on September 1, 1934. This made it possible

for the third- and fourth-year specialized courses to follow their logical sequence. The Department of Pharmacy at Howard College has continued to thrive since Dr. Bliss assumed the chairmanship.

According to a recent Bulletin, the name has been changed to the Division of Pharmacy. Its staff includes four with professional rank, with Dr. Woodrow R. Byrum as Director. The Division of Pharmacy moved into the new Robert I. Ingalls Hall on Howard's new campus in September, 1957. Two courses of study are offered. The four-year course is for students training as retail, hospital, wholesale, and manufacturing pharmacists. The five-year course is intended for those who want training as pharmaceutical analysts, inspectors in government bureaus, pharmaceutical journalists, and those who seek background for graduate study in pharmacy.

Education in pharmacy at Howard is young. But there have been about 680 graduates, and approximately 650 alumni are living.

In the state of Alabama there have been six departments or schools of pharmacy. Two of them still exist — one at Auburn University and the other at Howard College, Birmingham. Both schools are accredited by the American Council on Pharmaceutical Education with an A grade rating, and both are members of the American Association of Colleges of Pharmacy.

REFERENCES

1. The Annual Announcement of The Medical College of Alabama for the Session 1882-83, p. 13.
2. The Annual Announcement of the Medical College of Alabama for the Session 1883-84, p. 16.
3. The University of Alabama Bulletin, General Catalogues, 1907-1918.
4. Clark, Willis G. History of Education in Alabama, 1889, pp. 146, 151.
5. Blake, L. S. Pharmacy at Alabama Polytechnic Institute. Manuscript, 1956.
6. Graduate Program, Auburn. The Auburn Alumnus, Vol. IX, May, 1954, p. 4.
7. Twentieth Annual Announcement of the Birmingham Medical College, Department of Pharmacy and Pharmaceutical Chemistry. Matriculates and Graduates, 1912-13. Announcements for 1913-14, 23 pages.
8. Birmingham Dental College, Twenty-Second Annual Announcement, Catalogue 1914-15, p. 5.
9. B. O. Shiflett's School of Pharmacy, General Catalogue, 1921-22, 12 pages.
10. Birmingham-Southern College Bulletin, 1927-28, pp. 61, 94.
11. Birmingham-Southern College Bulletin, 1928-29, pp. 64, 197.

12. Proceedings of the One Hundred-Fifth Session, Alabama Baptist State Conventions, Nov. 16, 1956, pp. 65-68.
13. Howard College Bulletins, 1927-1931.
14. Howard College Bulletin, 1933.
15. Finch, John A., Dean, Howard College. Private communications, Oct., 1958, and Nov., 1958.
16. Alabama Pharmacy Law Regular Session, No. 423 (H. 192-Goodwyn), 1923, 16 pages.
17. Requirements for Registration as Pharmacist. Enacted by the Legislature of Alabama, 1931.
18. Pharmacy, Code of Alabama, 1940. Chapter 12, Title 46, 18 pages.

Some More Curves Derived from Watt's Linkage

Roland M. Harper

University, Alabama

At the 1959 meeting of the Alabama Academy of Science, I described several kinds of lemniscates produced in various ways and illustrated five groups of them. Three of these groups (and another one described then but not figured, for lack of space) were made by Watt's linkage, and two in other ways. The present study continues the investigation of the possibilities of Watt's linkage.

That linkage was developed by James Watt, the principal inventor of the steam engine, in 1784, and is the simplest possible linkage—having only three bars, jointed together endwise, with the outer ends firmly pivoted to a base. Curves derived from it have five parameters—namely, the length of the three bars, the base line or distance between pivots, and the position of the marking point on the middle bar. By setting up the system in any selected way and rotating it as far as it will go, any point on the middle bar can be made to trace a closed curve. If the end bars are equal, the middle bar is shorter than the base line, and the marking point is the mid-point of the middle bar, the resulting curve will have the general appearance of a lemniscate. However, according to the Encyclopaedia Britannica (article on Curves, special), it is a sextic (curve of the sixth degree) while a typical lemniscate is of the fourth degree.

By moving the marking point between the joints or beyond them, an infinite series of curves can be drawn; and this can be repeated for any and every adjustment of the length of the bars and the distance between pivots.

R. C. Yates, in his book *Curves and Their Properties* (1947), demonstrated how two different modifications of Watt's linkage, one of them with end bars unequal and marking point beyond one of the joints, could produce an apparently normal lemniscate; and in my 1959 paper I showed how various other curves, some of them not lemniscates at all, could be executed with the same setup of bars but with different marking points. All sorts of fantastic curves could be traced by changing the lengths of the bars. But at this time I will deal only with equal end bars, which give complications enough.

In my 1959 paper I mentioned that, if a linkage with the proportions shown in the first Webster's Dictionary entry under "straight line" were used, the mid-point of the middle bar would trace a sort

of vertical lemniscate with sides straight (or nearly straight) for a considerable distance. This may be what Watt used to get a straight line motion for his piston rod. I exhibited a drawing of it at the time, but did not include a figure of it in the published paper for lack of space. It appears here now as Fig. 1. By moving the marking point

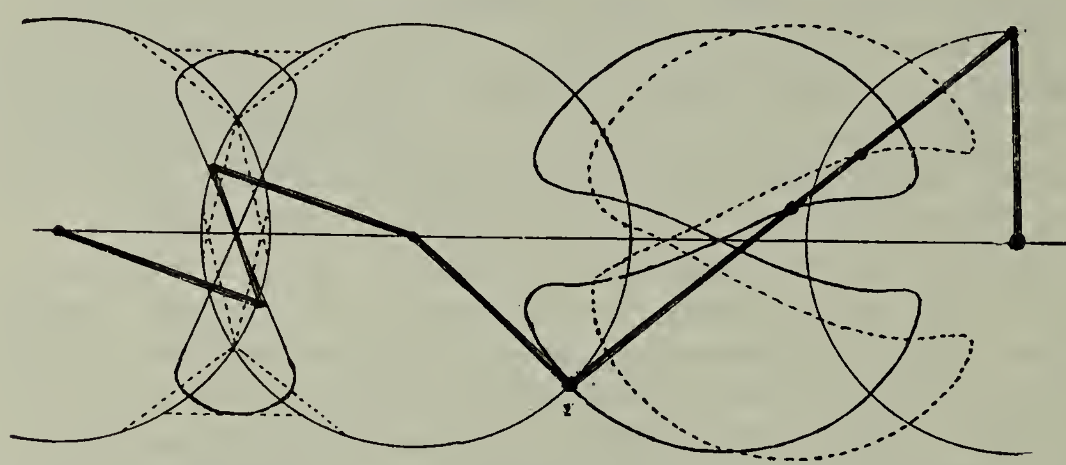


Fig. 1. Lemniscate-like curve made with a Watt's linkage of the proportions shown in Webster's dictionary. Its sides are straight or nearly so for most of their length. One position of the bars is shown, corresponding to that in the dictionary. Several positions of the middle bar are indicated by dotted lines.

Fig. 2. Lemniscate-like curves made by a linkage with the middle bar nearly equal to the base line. In the one drawn with a continuous line the marking point is in the middle of the middle bar, and the central portion approaches a horizontal lemniscate, as explained in the text. In the dotted curve the marking point was away from the middle. One position of the bars and the corresponding marking points for each are shown for both curves at the same time.

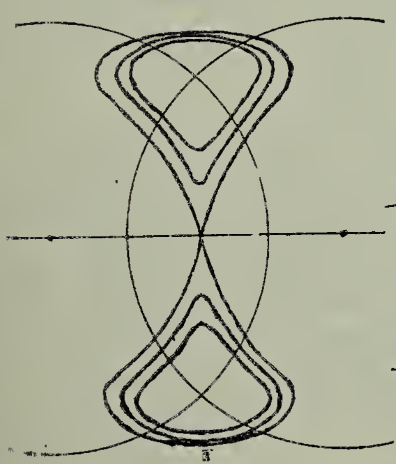
on the middle bar, we can get various lopsided lemniscates, something like those in Fig. 1 of my 1959 paper.

Now let us make the middle bar nearly equal to the base line and the end bars a little shorter. The mid-point of the middle bar will trace a widened lemniscate with jaw-like extremities nearly meeting on both sides (Fig. 2). This, unlike a true lemniscate, can be intersected by a straight line at six points, proving that it is at least of the sixth degree. If we move the marking point one way or the other, we can get some odd curves. Some of them suggest crab's claws, an example of which is seen in Fig. 2.

Next we may make the middle bar equal to the base line, as Yates did in one of his examples. The jaws shown in Fig. 2 will come together, forming a horizontal lemniscate (mentioned but not illustrated under Watt's curve in the Encyclopaedia article previously

cited). It will still have the surrounding circle, which Yates did not show. If the marking point is moved, the circle will remain the same, but the included lemniscate will change, making curves suggesting some of those obtained by the McLees method, which I described at our 1956 meeting.

For another variation let us make the end bars about three-fourths of the length of the base line and the middle bar a little more than half the base line. The mid-point of the middle bar will trace a sort of wasp-waisted lemniscate (Fig. 3).



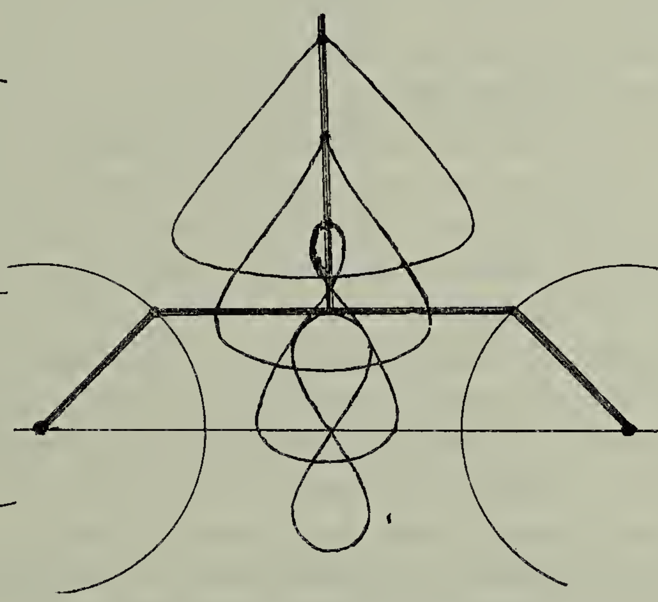


Fig. 3. Curves produced by Watt's linkage when the middle bar is approximately equal to the overlap of the end bars. In the outer (continuous) one it is a little longer and the two inner pairs of curves are produced by successively shorter middle bars. The marking point is in the center of the middle bar in each case.

Fig. 4. Some curves produced by a Watt's linkage with end bars not overlapping, and offsets of varying length attached to the center of the middle bar. In the symmetrical (lowest) one, the length of the offset is zero. The others are based on offsets of different lengths, as explained in the text. If space had permitted making the offset twice as long as the middle bar, the lower chord of the resulting curve would have been a straight line for much of its length. The bars are shown in their upper central position.

Then shorten the middle bar slightly, so that when added to the base line it will be a little less than the sum of the end bars. This way its mid-point cannot be rotated past the base line, and the lemniscate will break up into two similar curves on opposite sides of it, suggesting some of the pairs of Cassinian ovals produced by slicing a dough-

nut-shaped ring. But these curves have flex points, which the Cassinian ovals do not; and in this respect they resemble some of the curves of the McLees series, described in my 1956 paper on ovals.

Fig. 3 shows the lemniscate just mentioned, and also two pairs of curves inside it, resulting from different (and shorter) lengths of the middle bar. It is interesting to note here that if this lemniscate be rotated on its axis, making a solid of revolution, something like a dumb-bell, any plane slicing through it parallel to its axis will make a pair of curves like the inner ones shown in the figure, just as could be done with a Cassinian lemniscate and associated ovals. Their size will vary with the distance of the slicing plane from the axis, and if the plane is tangent to the solid of revolution, they will reduce to points corresponding with the two intersections of the governing circles where the middle bar is reduced to zero.

This setup is something like the linkage used by Chebychev in an attempt to draw a straight line without a ruler, described under "straight line" in Webster's dictionary. According to the Encyclopaedia Britannica (under Linkage) P. L. Chebychev (also spelled Tchebichev and Tchebichoff) was a distinguished Russian mathematician who spent much time trying to devise a linkage that would produce rectilinear motion. He did not quite succeed, but one of his pupils, Lipkin, did; not, however, until a more perfect one, with seven moving parts, had been devised by A. Peaucellier, a French mathematician (this also shown in the dictionary entry).

The dictionary illustration of Chebychev's linkage shows a sort of letter X with a bar across the top, a modification of Watt's linkage. The horizontal or middle bar is intersected in the middle by a short vertical dotted line, presumably representing the desired straight line. But if I have interpreted the figure correctly, it will produce, instead of a vertical line, a narrow closed curve oriented horizontally, something like a wooden coat-hanger or a section of a meniscus lens. However, if we make the middle bar equal to the base line and the end bars like the diagonals of a square, the mid-point of the middle bar will trace a curve something like two semi-circles connected by straight lines approximately equal to their radii, suggesting a longitudinal section of a medicine capsule. This may be what Chebychev had.

Finally, let us set up the linkage in any convenient way and put the marking point on an offset to the middle bar, making a sixth parameter. As in the previous examples, the shape of the resulting curves will depend largely on the relative lengths of the base line and bars. But in this case the middle bar is five-eighths the length

of the base line, and the end bars a little more than one-fourth.

Starting with a short offset attached at the mid-point of the middle bar, we get first an upright lemniscate with unequal lobes (Fig. 4), suggesting the analemma mentioned in my 1959 paper. Farther out, the lower lobe of the lemniscate widens, and its upper lobe reduces to a point or cusp. Beyond that, the curve continues to widen, and the cusp rounds out. When the offset is equal to the middle bar, we get something like a triangle with convex sides and rounded corners.

Space did not permit carrying the figure farther, but we may note that, in this case at least, when the offset is twice the length of the middle bar, we get a curve something like a cross-section of a plano-convex lens, wider than the middle bar and with the edges rounded. Still farther out, the lower surface of the curve becomes concave, like a section of a meniscus lens.

The plano-convex stage affords another way of drawing a straight line with a linkage, much simpler than Peaucellier's. Something like this is called Robert's method in the dictionary article already referred to. But in the figure used to illustrate it, the offset was only about the same length as the middle bar, and it was stated that the resulting straight line was only approximate and that it could be made accurate by substituting slots and swiveling blocks for the swinging links.

Some freakish results could be obtained by attaching the offset to the middle bar somewhere other than at its mid-point or by making the end bars unequal. For the present I will leave that to the imagination of my readers and to any enthusiastic students they may have.

All these curves should have pretty complicated equations and still more complicated evolutes, but I have not gone into that at all.

Ground Water in Relation to the Russellville Brown Iron Ores

Jack E. Morris

United States Pipe and Foundry Company, Birmingham

Brown iron ore has been mined in the Russellville district more or less continuously since 1818 when the state's first furnace was built on Cedar Creek. The first ores mined were, of course, the red dirt surface deposits which in those days covered several hundreds of acres east and south of the present site of the city of Russellville.

The Russellville brown iron ore deposits are located almost exclusively in Franklin County, Alabama. The known mineral zones strike along a north-east, south-west trend from southeastern Colbert County to well below the southwestern Franklin County line. The mineralized zone is from 30 to 35 miles in length; the width varies from narrow isolated "fingers" to well over 9 miles. This does not mean that this entire area is mineralized, but merely that discontinuous pockets of irregular size occur within this zone.

The topography of the ore zone differs considerably from one end to the other. Plateau areas occur in the northeast, produced by the flat-lying Hartsell sandstone and Bangor limestone. Southwestward from the present city of Russelville, the topography is much more rugged.

The northern limit of the district is at the Hartsell sandstone escarpment, which roughly marks the southern edge of the Tennessee Valley. The southern limit is found at the escarpment of the Pennsylvania Pottsville sandstone. This escarpment is known locally as Spruce Pine Mountain and regionally as Sand Mountain. However, this escarpment disappears in the southwestern area and is buried beneath Tuscaloosa gravels of Cretaceous Age. The area between the two escarpments is underlain mainly by Bangor limestone of Upper Mississippian Age.

Early geologists placed the Russellville ores in the Lafayette formation, a late Tertiary deposit of sands and gravels, generally thought to be the result of stream terracing. However, after spending ten years actively conducting exploratory drilling in the area, I cannot agree.

Let us begin with the ores found in the northeastern end of the district. This region is a plateau, and the ore occurs as thin

lenses within a sandy red clay. There is no uniform pattern of lenses; they are scattered haphazardly over the area. The pit bottoms exhibit a "hardpan," perhaps a weathered phase of the Hartsell, below which there is no ore. Some pits do, however, exhibit Bangor limestone, the formation immediately above the Hartsell. It is my thought that during Tuscaloosa time there were thin outliers of Bangor scattered about the area, and these were favorable for simple replacement in the shallow seas which covered the region. The favorable zones of Bangor were probably high in calcium content and low in impurities, thus accounting for the fact that these ores contain the highest iron content and the lowest insoluble content of any of the Russellville district ores. If the ore had been developed in the Hartsell, then the insoluble content would be expected to be higher. This region did not receive an abundance of gravel as did the areas to the southwest. But it did receive sands and clays, with minor amounts of well-rounded chert pebbles. Possibly it was farther from the source materials or was an isolated quiet shallow bay.

The ores of this northeastern end of the district may be classed as primary because they are in no way similar to red dirt float ores found immediately east of the city of Russellville, which are classed as secondary deposits. Ores in the northeastern area may be judged to have remained where they were formed because coarse and fine ores are intimately mixed. This is not the case of true secondary deposits in which segregation has occurred. Quite naturally, when eroded, an original primary deposit will drop the heaviest material at the first opportunity, carrying the fines farthest or removing them altogether. Another reason for believing that these ores are primary is their elevation. All are at approximately the same elevation, whereas secondary deposits are found at varied elevations. These deposits are dry, due to the porosity of the underlying sandstone and the high elevation of the plateau.

Along the strike southwestward toward the city of Russellville, long barren zones are encountered. These zones show outcroppings of Bangor limestone, protruding through a thin residual soil mantle as small hummocks and pinacles. A small escarpment at the contact of the Hartsell and Bangor can be seen in the vicinity of Mountain Star. No ore occurs in these zones for two reasons: (a) The limestone was unfavorable for replacement. (b) No Tuscaloosa formation exists in this region. Perhaps the area was uplifted or was higher in elevation during Tuscaloosa time and hence received no source materials.

In these zones the Bangor limestone is dense and compact and exhibits few cavities or sinks. It is a very poor aquifer. Most of the domestic wells are in the shallow soils which produce water at the rock contact. The wells drilled into the Bangor are dry, or very small producers, such as one gallon per minute. Often the water is high in sulphur. Drill cuttings show pyrite disseminated in the limestone in certain localities but it is not found in the limestone below ore deposits.

As we approach the area immediately east of the city of Russellville, topographic and stratigraphic changes can be noted. Here we see the first high hills, which are composed of Tuscaloosa sand, gravel, and clay. This is the area also of widespread secondary, red dirt float ores, together with numerous primary deposits. Because of the magnitude of the secondary deposits, we may assume that erosion of the primary deposits was very rapid for a period of time after the formation of the ore and before man made his appearance on the scene.

Mining has been longest and most active in this area. The easily accessible out-cropping float ores were first mined by hand and hauled by oxen. Ore was dry screened. Later came the simple log washers, steam shovels, and dinkey transportation. This advance increased the extensiveness of the mining, although it too had its depth limitations. Finally, came the era of large drag lines and truck transportation, together with advanced-design washers and heavy-media concentration plants. This technology allowed deep mining of primary deposits heretofore unobtainable. In this area the Sloss-Sheffield Steel and Iron Company in 1946 constructed the first heavy-media plant in the United States to treat brown iron ores. It was, moreover, the fourteenth heavy-media plant to be placed in operation in the United States. This advance permanently eliminated the picking belt.

The hills in this area are covered with Tuscaloosa gravel which contains irregular erratic lenses of hard conglomerate, known locally as "cap rocks." The only primary ore is found under or within these hills, occupying higher elevations than do the secondary deposits. The cap-rock hills were more resistant to weathering and erosion than portions of the surrounding deposits. Therefore, with the erosion of non-resistant Tuscaloosa and subsequent erosion of many of the primary deposits, the secondary deposits were formed.

There is another distinction between primary ores and secondary ores. This is the grade. Primary ores are lower in iron content. Secondary deposits are always higher in iron content because,

during the process of erosion and redeposition, the fines and lower-grade materials have been removed.

It may be emphasized here that the area east of Russellville was by far the most important mining area from 1818 to early in the 1900's. Test-pitting was easy in the soft red dirt, much of the ore was near the surface, and recovery ratios were high. Furthermore, in most cases, the ore deposits were dry. Water was never a serious problem in mining. Because of the clay bottoms in most of the pits, they are now excellent reservoirs for the storage of rain water. These pools and ponds feed three large lakes located in this region.

The area southwest of Russellville was largely neglected during the early period because most of this region is covered with Tuscaloosa gravel, and ore outcrops are few. Except for isolated localities, very little exploration or mining was done here until 1918. Due to the ease of mining east of town, operators were reluctant to spend money for adequate exploration. From 1900 to 1940, exploration was done by means of hand-dug test pits. The depth of these holes was limited. They often had to be abandoned at an early stage owing to heavy layers of conglomerate or to excess water.

The topography changes west of Russellville; the terrain becomes much more rugged; the outcrops of Bangor occur abruptly at erratic elevations. The ore pockets rarely occupy the tops of the ridges as they do east of town, but lie on the flanks and in the valley bottoms. Large deposits are found associated with the present drainage system. Typical deposits in this region are primary. Secondary deposits are few, shallow, and unimportant. None of the deposits compare in grade with those east of town.

Some deposits are composed entirely of ore "fines or sands" and, consequently, are low grade. Because they are porous, they contain an abundance of water. All of the ore deposits west of Russellville are water bearing, and water becomes a serious problem to the mine operator. Generally, the water-table level appears to be high west of Russellville.

It should be noted that mineralization did not take place in all of the hollows or valleys. Various hollows show no mineralization whatsoever, even though surface gravel and other geologic clues might so indicate. There is no established geologic clue or physical feature usable as a guide for exploration. We know that the deposits occur above limestone. So we look for areas where limestone is not present. These areas are drilled in the hope of

discovering an ore pocket below the gravel. Such areas are just as likely to be barren as they are to contain ore. We avoid the crests of the ridges because they are normally barren.

Where did the iron come from? I have observed no pyrite, no pseudomorphs of pyrite in the ore; no glauconite and no siderite. I believe the iron was obtained from the Tuscaloosa by circulating ground water and that it was deposited in favorable phases of the Bangor limestone by simple chemical action.

Unusual physical features occur in the limestone west of Russellville. During the long erosional period between the end of the Paleozoic and the Tuscaloosa Period, the Bangor limestone must have been continually uplifted, developing deep erosional channels and/or stream channels. Cavities developed too. There was no development of residual clays during this time, and the landscape must have presented a barren appearance. After the deposition of the Tuscaloosa, which filled these old channels with sand and gravel, iron ore began to form. Extensive drilling in the area has proved that the Tuscaloosa is in direct contact with the Bangor, with no residual clay present, particularly in areas barren of ore. In some few cases, a mantle of residual clay is found below the gravel, but I am sure that this has developed since Tuscaloosa time.

The old channels present in the Bangor compare with those found in the Fence Lake area of Valencia County, New Mexico. During Tertiary time, deep channels were cut in the Mesa Verde formation and filled with sands and gravels. Later, lava flows covered the area. This arid region has been well irrigated by the abundance of water carried in those old stream channels.

Exploratory drilling for iron has revealed the existence of several of these old gravel-filled channels west of Russellville, some traceable for several miles. Those which are free of iron ore could easily supply the water the city of Russellville needs.

Because water is abundant west of town, the dowsers, or water-witches, have a field day. Not so, east of town. There the score is much lower, and success belongs in the realm of pure chance.

Although we have paid little attention to dowsing, perhaps we should take up the peach limb in our search for ore. For if the stick dips as it is allegedly supposed to do where water lies, we might find ore there too.

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal, should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 32 APRIL, 1961 NUMBER 2

THE JOURNAL

of the

ALABAMA ACADEMY

OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 32 APRIL, 1961 NUMBER 2

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

Amphibians and Reptiles of the Howard College Natural Area

J. Alan Holman
Howard College, Birmingham

INTRODUCTION

This report deals with the results of a program of intensive collecting and observation on the herpetofauna of a 60-acre tract of land set aside as the Howard College Natural Area. Fourteen species of amphibians and 25 species of reptiles recorded in the two-year period of collecting in the area form the basis of the present paper.

The Howard College Natural Area was formally dedicated April 8, 1960. It is intended to serve as a facility for the education of public groups, as an outdoor laboratory for biology classes, and as an area for biological research. The Natural Area lies in part on the north slope of Shades Mountain and in part in Shades Valley, both in the City of Homewood and within the greater Birmingham area of Alabama.

Physiographically the Birmingham area represents a southern intersection of fingers of the Cumberland Plateau and Appalachian Mountain systems. It lies at the boundary of the Carolinian and Austroriparian biotic provinces. The major plant formation is that of temperate deciduous forest, but the area is in the oak-pine subclimax (ecotone) according to Pitelka (1941). This composite nature of physiographic and biotic provinces and of plant formations makes the Natural Area a critical one for plant and animal studies.

The Natural Area consists of two general habitats: (1) The "Shades Mountain slope" includes the major part of the Natural Area and occupies a segment of the north side of Shades Mountain. This division has a mainly mesophytic vegetation, but there are several stands of pine where lumbering formerly occurred. The slope is dissected by many streams with beds of shale and sandstone. The Howard College Nature Trail winds through this part of the Natural Area. (2) "The Shades Valley flood plain" occupies a small portion of the Natural Area. It is separated from the Shades Mountain slope by a black-top road. The major controlling factor of the flood plain is Shades Creek, which periodically leaves its banks during spring rains, and forms a typical flood plain topography, although on a small scale. For a description of the vegetation of the Birmingham area see Harper (1928, and 1943).

The first amphibians and reptiles were systematically collected by Dr. Robert D. Weigel in 1958 and 1959. Work was continued and intensified from September, 1960, through May, 1961. I should like to thank Dr. Herbert McCullough of the Department of Biology at Howard College for his encouragement of this project, Dr. Robert D. Weigel of Illinois State Normal University for his initial contributions, and the students in the vertebrate field zoology classes at Howard College for their aid in the collection of specimens.

ANNOTATED LIST

The systematic arrangement of the animals in the following list follows Schmidt (1953); the usage of vernacular names follows that of Conant et al (1956). Specimens collected from the Howard College Natural Area reside in the Howard College Collections in the Biology Building.

Amphibians

Ambystoma maculatum (Shaw).—Material: HC 150, and 242. In the two available specimens: length 141-161 mm., costal grooves 12; dorsal spots 30-40.

Both specimens are from the Shades Valley flood plain. One specimen was found dead February 23, 1961.

Ambystoma opacum (Gravenhorst).—Material: HC 351. In the single specimen: length 88 mm., costal grooves 12; dorsal black bands and spots 15, dorsal white bands 15.

The above specimen was discovered beneath a flat board April 22, 1961, on the Shades Mountan slope, and is the only record of this species from the Natural Area.

Desmognathus fuscus fuscus (Rafinesque).—Material: HC 127 (2), 131 (6), 185, 197 (3), 208, and 280 (5). In the 17 transformed individuals: length 37-125 mm., costal grooves 13-14; young individuals usually with 8-10 pairs of light dorsal spots, adults highly variable in markings and coloration.

The adult pattern usually consists of either a dark ground color with lighter irregular markings, or a light ground color with darker irregular markings. Some large individuals are almost uniformly dusky, but finely stippled with tiny white specks. Two individuals have a pattern supposedly diagnostic for *Desmognathus aeneus chermocki* (Bishop and Valentine) which consists of a wide, light, dorsal stripe with wavy edges, and with irregular dark spots within the stripe.

The smallest transformed individual measures 37 mm., whereas

the single larval individual measures 67 mm. One individual in series HC 131 is polydactylous, and has six toes on the left hind foot. Its other feet are normal.

The dusky salamander is the most aquatic salamander in the Natural Area. It is almost always taken under submerged or partially submerged rocks in the stream beds. Individuals attempt to escape by swimming into the stream, or by withdrawing into holes under the rocks. The species is quite active throughout the winter months and, considering its great abundance in the Natural Area, would be an ideal subject for an ecological study.

Plethodon dorsalis dorsalis (Cope).—Material: HC 207 (2), 272 (6), 274 (4), and 279 (3). In twelve adults: length 61-81 mm., costal grooves 16-17; dorsal band wavy and salmon pink in color.

The zig-zag salamander is the most abundant salamander of the wooded slopes of the Natural Area. It may be found under loose shale, rotting wood, and piles of leaves. One individual was found inside a rotting pine stump.

Plethodon glutinosus glutinosus (Green).—Material: HC 273, 306, and 357 (2). In two adults: length 124-165 mm., costal grooves 16; dorsum sprinkled with white specks, lower sides heavily mottled with irregular white spots.

The slimy salamander is also an inhabitant of the wooded slopes and may be found by turning rotting logs and stumps. It is not as abundant as the preceding species.

Pseudotriton ruber ruber (Sonnini).—Material: HC 350. In the single adult specimen: length 116 mm., costal grooves 16; ground color salmon red, with a profusion of irregular black spots extending to the tip of the tail; iris red, not yellow as in most populations.

The only specimen from the Natural Area was collected from beneath a large rotting log on the Shades Mountain slope April 22, 1961. The specimen disgorged the tail of a large ground lizard (*Lygosoma laterale*).

Eurycea longicauda guttolineata (Holbrook).—Material: HC 1, and 56. In the two adults: length 82-98 mm., costal grooves 14; with two lateral and one dorsal black stripe.

The three-lined salamander is rather rare in the Natural Area. Both specimens were collected from the Shades Mountain slope near creek beds.

Bufo woodhousei fowleri (Hinckley).—Material: HC 355, and 387. In the adult male and female specimens: snout-vent length 57-75 mm.; dorsal black spots with three warts per spot, chest and venter

plain; cranial crests in contact with paratoid, and without a swollen knob posteriorly.

Fowler's toad is very common in the Natural Area but is most abundant in the Shades Valley area. The first breeding choruses were heard at 7:00 p.m. on April 22, 1961. This was after three consecutive days with the temperature reaching the upper seventies or low eighties.

Hyla crucifer crucifer Wied.—The first choruses of the spring peeper were heard from the Natural Area February 15, 1961. As yet there are no preserved specimens from the Natural Area, but specimens from a few miles away are easily assigned to the above subspecies.

Hyla versicolor versicolor Le Conte.—Material: HC 288. In the single adult: snout-vent length 45 mm.; ground color gray, with dusky dorsal markings, a light line extending from the eye to the angle of the mouth; ventral surface of hind legs bright yellow.

The gray tree frog is common in the Natural Area, especially in the Shades Valley flood plain. The first choruses of these frogs were heard from almost all wet portions of the Shades Valley area at 7:00 p.m., April 22, 1961.

Pseudacris triseriata feriarum (Baird).—Material: HC 223. In the single adult male: snout-vent length 28 mm.; with a light line along upper lip, and a dark stripe extending from the snout to the groin, and passing through the eye; with three rows of rather large spots on the dorsum, but with smaller spots scattered between the larger ones; dark triangle present between eyes.

The upland chorus frog was the first species of frog to breed in the Natural Area in 1961. The first choruses were heard on February 10, 1961, at 11:15 p.m. The air temperature was 22 degrees C. about one foot above the ground. The water temperature in a temporary puddle about 2-5 inches in depth (from which several individuals were calling) was 13 degrees C. Most choruses were from the Shades Valley area.

Gastrophryne carolinensis carolinensis (Holbrook).—Material: HC 393. In the single adult specimen: snout-vent length 29 mm.; venter strongly pigmented, and without threadlike light lines.

Only one specimen of the eastern narrowmouth toad has been observed in the Natural Area. This specimen was collected on the black-top road that separates the Shades Valley flood plain from the Shades Mountain slope, on May 15, 1961.

Rana catesbeiana Shaw.—Material: HC 133, 287, 343, and

356. In a newly transformed individual: snout-vent length 37 mm. In an adult female: snout-vent length 131 mm.

Bullfrogs from the Natural Area are closer to more northern populations in that the dorsal pattern is light, and not heavily pigmented with gray, and in that the venter is very lightly mottled. The bullfrog is very common in the Shades Valley area, but has also been seen in the small pond near the start of the Nature Trail on the Shades Mountain slope. The first choruses of these frogs were heard on the night of April 22, 1961.

Rana pipiens sphenocephala (Cope).—Material: HC 236. In the single adult female: snout-vent length 74 mm.; dorsal spots 20, tympanum with a central light spot.

The southern leopard frog is fairly common along roadside puddles and other wet places in the Shades Valley area. The first choruses were heard the night of April 22, 1961.

Reptiles

Chelydra serpentina serpentina (Linnaeus).—Material: HC 205, and 240. The two specimens are juveniles, and were taken crossing the road. One specimen was collected February 23, 1961.

Kinosternon subrubrum subrubrum (Lacepede).—Material: HC 203, 239 (2), and 268. In two adult individuals: length of carapace 95-103 mm.; three individuals with sides of the head with three yellow spots, one with sides of the head with three yellow and two brown stripes.

All of the specimens were taken crossing the road. Two were found as early as February 22, 1961.

Terrapene carolina carolina (Linnaeus).—Material: HC 204. In the single small specimen: length of carapace 78 mm.; with a well-developed pattern of orange dorsal blotches; posterior marginals directed vertically; hind toes four.

The specimen from the Natural Area, as well as three other individuals taken within a few miles of the Natural Area, all fall into the subspecies *T. carolina carolina*, although Carr (1952) indicates that the Birmingham area is in a zone of intergradation between the eastern box turtle, *T. carolina carolina* (Linnaeus), and the three-toed box turtle, *T. carolina triunguis* (Agassiz).

The eastern box turtle is common throughout the Natural Area, and frequently seen dead on the road.

Pseudemys scripta troostii (Holbrook).—Material: HC 369. In the single juvenile specimen: plastron with six pairs of small black ocelli; without red postorbital patch, but with postorbital patch yellow and narrow; yellow stripes on head and legs relatively wide.

The single specimen available from the Natural Area is clearly *P. scripta troostii,* although the range maps of both Carr (1952) and Conant (1958) indicate that *P. scripta elegans* occurs in the Birmingham area. According to Conant, whose range maps are most standardly accepted by herpetologists, the subspecies *P. s. troostii* (Holbrook) barely enters the northeastern tip of Alabama, the subspecies *P. s. elegans* (Wied) occupies the remaining part of northern Alabama, and intergrades with *P. s. scripta* (Schoepff) in the southern half of the state. Many *P. scripta* have been observed by the writer in northern Alabama, but the characteristic red postorbital patch of *P. s. elegans* has never been seen in the field. Moreover, three juvenile specimens of *P. scripta* from the Tennessee River at Florence and Decatur, Alabama, as well as one from the Black Warrior River near Port Birmingham, are clearly referrable to *P. s. troostii.*

Trionyx sp.—Soft-shelled turtles are frequently observed sunning along the muddier banks of Shades Creek, but are impossible to identify as to species by sight.

Anolis carolinensis carolinensis Voigt. — Material: HC 283 (2), and 348. In the three adult specimens: snout-vent length 43-53 mm.

The green anole is a fairly common lizard in certain situations in the Natural Area. It shuns the heavily shaded slopes, but may be seen in many sunlit, open situations. It is fairly common in the Shades Valley area where it may be found in bushes and vines.

Sceloporus undulatus hyancinthinus (Green).—Material: HC 212, and 304. In an adult male specimen: snout-vent length 66 mm.

The fence lizard is common in open situations throughout the Natural Area.

Ophisaurus attenuatus attenuatus (Baird).—Material: HC 199. In the single adult female: snout-vent length 225 mm.; with mid-dorsal stripe wide and complete, and with two lateral stripes below the lateral groove.

The above female was taken October 12, 1961. This specimen has a fresh mating scar on her nuchal area, thus indicating that this species breeds in the fall.

Lygosoma laterale (Say).—Material: HC 64, and 345. In the two adult specimens: snout-vent length 32-34 mm.

The ground lizard is ubiquitous in the Natural Area. It is most commonly found beneath litter and leaves.

Eumeces sp.—Only one blue-tailed lizard has been seen on the Natural Area, and this specimen eluded capture.

Natrix septemvittata (Say).—Material: HC 198 (2). In the two

juvenile specimens: ventrals 143-145, caudals 72-76, scale rows at mid-body 19.

The two specimens were taken at Shades Creek.

Natrix erythrogaster flavigaster Conant. — Material: HC 342. In the single adult female: length 92.7 cm. (with part of tail missing), ventrals 136, scale rows at mid-body 23; dorsum without pattern, brown in coloration; venter very light pink, nearly plain, but with anterior edges of the ventrals dusky.

The specimen from Shades Creek is assigned to the subspecies *N. e. flavigaster* with some degree of reservation. The plain brown dorsum and light pink venter show there may be intergradation with populations to the east called *N. e. erythrogaster* (Forster). Conant (1958, p. 326, map 89) delimits the two subspecies at Chambers County in southeastern Alabama.

Storeria dekayi wrightorum Trapido. — Material: HC 136, 241 (2), 282, 308, and 390. In the six adult specimens: length 18.9-36.2 cm., ventrals 130-133, caudals 47-60, scale rows at mid-body 17; with dorsal spots fused to form short dorsal cross-bands.

Dekay's snake is an abundant and ubiquitous member of the herpetofauna of the Natural Area. A male and a female specimen were taken engaging in copulatory activity on February 23, 1961. Individuals are usually found hiding beneath various objects during the day, but are often found prowling about in the open at dusk in the warmer months.

Storeria occipitomaculata occipitomaculata (Storer).—Material: HC 65, 238, 271, and 394. In the four adult specimens: length 210-257 mm., ventrals 123-125, caudals 43-44, scale rows at mid-body 15.

The variation in pattern in the four specimens is striking. The two extremes in markings and coloration are as follows: HC 238 has a distinct chocolate brown spot on the rostrum that covers the internasals, prefrontals, and the anterior half of the frontals and preoculars. The characteristic lateral spots behind the head are chocolate brown. The ground color is purplish-black, almost identical to that found in *Diadophis punctatus,* and a very distinct chocolate brown stripe runs the entire length of the mid-dorsal region. The venter is pale orange. HC 271 has the chocolate brown rostrum, but lacks the mid-dorsal stripe, and the purplish-black ground color. In this specimen the dorsum is entirely chocolate brown, there are no lateral spots behind the head, and the venter is lemon yellow. It seems ludicrous to use the accepted vernacular name "red-bellied snake" for these specimens.

This is a much more rarely encountered snake in the Natural

Area than is Dekay's snake. Two of the specimens were taken on the road in the daytime after heavy rains, and one specimen was found prowling about at dusk.

Thamnophis sirtalis sirtalis (Linnaeus). — Material: HC 209, 211, 270, 281, and 305. In two adult females: length 54.2-57.7 cm., ventrals in four specimens 147-153, caudals in three specimens 62-74, scale rows at mid-body in four specimens 19.

The eastern garter snake is a common form in the Natural Area. It is more frequently found in the Shades Valley flood plain than in the Shades Mountain slope.

Haldea valeriae valeriae (Baird and Girard).—Material: HC 392. In the single adult specimen: length 22.0 cm., ventrals 123, caudals 29, scale rows at mid-body 15.

The only record of the eastern earth snake from the Natural Area is the above specimen. It has a uniformly reddish-brown dorsum, with a few unevenly distributed black stipples. The venter is pink.

Diadophis punctatus punctatus x *edwardsi* x *stictogenys*.—Material: HC 278 (2), 307 (2), 346 (2), 352, 358, and 388 (3). In the eight adult specimens: length 22.9-32.6 cm., ventrals 139-152, caudals 40-53, ventrals plus caudals 189-201, scale rows at mid-body 15.

The population of ring-necked snakes at the Howard Natural Area represents an intergradation of three subspecies, *D. p. punctatus* (Linnaeus) which occurs to the south, *D. p. edwardsi* (Merrem) which occurs to the north, and *D. p. stictogenys* (Cope) which occurs to the west.

In ten of 11 specimens there are eight labials, a character of *punctatus;* in one of 11 there are seven labials, a character of *stictogenys.* In ten of 11 there is a ventral plus caudal count ranging from 192-201, a character of *edwardsi;* in one of 11 there is a ventral plus caudal count of 189, a character of *punctatus.* Six specimens have single, half-moon shaped ventral spots, a character of *punctatus;* five of 11 have a combination of the half-moon shaped single spots of *punctatus,* and the paired spots of *stictogenys.* Ten of 11 have the highly spotted chin of *punctatus*, whereas one has the almost plain chin of the other subspecies.

The ring-necked snake is very common in all parts of the Natural Area. It is usually found under various objects, and in rotting wood.

Carphophis amoenus amoenus (Say).—Material: HC 104, 347, 349, 359, and 391. In four adult specimens: length 20.3-22.3 cm.,

ventrals 116-127, caudals 25-38, scale rows at mid-body 13; with frontal and internasal scales separate in all five specimens.

The eastern worm snake is common throughout the Natural Area. It may be found under various objects and in rotting wood. Specimens have never been seen in the open.

Coluber constrictor constrictor x *priapus*.—Material: HC 154, 210, and 153. In the three specimens: ventrals 178, caudals 93-98, scale rows at mid-body 17; with the enlarged basal hemipenial spine of the male specimen less than three times as long as its predecessor in the same row; labials, chin, and throat of all three specimens almost entirely white.

The character of the hemipenial spine is indicative of *C. c. constrictor* (Linnaeus), the subspecies to the north and east, but the white chin and throat is a character of *C. c. priapus* Dunn and Wood, the subspecies to the south and west.

The black racer is common throughout the Natural Area.

Elaphe guttata guttata (Linnaeus).—Material: HC 389. In the single female: length 132.5 cm., ventrals 219, caudals 44, scale rows at mid-body 26.

Only one corn snake, a huge female, has been taken on the Natural Area, although several juvenile specimens, as well as one adult, have been collected from adjacent Howard College property. HC 389 is very dark in color, and the dorsal blotches, as well as the characteristic spear points on the top of the head, are quite indistinct. This is probably a reflection of the large size of the specimen.

Elaphe obsoleta spiloides (Dumeril, Bibron, and Dumeril).—Material: HC 202. In the single juvenile specimen: ventrals 238, caudals 85, scale rows at mid-body 24.

A single juvenile specimen found dead on the road is the only gray rat snake from the Natural Area. Adult specimens from the Birmingham area have the characteristic dorsal blotches of the above subspecies.

Lampropeltis calligaster rhombomaculata (Holbrook).—A specimen was captured March 26, 1961, on the Shades Mountain slope, but later escaped. This is the only record of the mole snake from the Natural Area.

Lampropeltis getulus niger (Yarrow).—Material: HC 374. In the single juvenile specimen: ventrals 211, caudals 45, scale rows at mid-body 22.

The above specimen was taken from under litter in the Shades Valley area, and is the only record of the black kingsnake from the Natural Area.

Ancistrodon contortrix mokeson (Daudin).—Material: HC 396. In the small specimen: ventrals 151, caudals 44, scale rows at midbody 22; with hourglass markings relatively wide and complete across dorsum.

The specimen was taken at dusk crawling across the road. It was being attacked by two mocking birds, who were dancing around the snake excitedly. This is the only record of the copperhead from the Natural Area, although two have recently been killed on adjacent Howard College property.

DISCUSSION

The composite nature of physiographic and biotic provinces and of plant formations in the Birmingham region is reflected by the composition of the herpetofauna of the Howard College Natural Area. The relationships of these amphibians and reptiles are equally divided between the Carolinian biotic province to the north and the Austroriparian biotic province to the south.

In order to diagnose zoogeographic relationships, the center of distribution of the range of each form was plotted. Some forms have very wide ranges in North America, and thus are about as common in one biotic province as the other. Such forms are not useful in the diagnosis of zoogeographic relationships, and include: *Ambystoma maculatum, Ambystoma opacum, Plethodon glutinosus glutinosus, Hyla crucifer crucifer, Pseudacris triseriata feriarum, Rana catesbeiana, Chelydra serpentina serpentina, Sceloporus undulatus hyacinthinus, Storeria dekayi wrightorum, Storeria occipitomaculata, Thamnophis sirtalis sirtalis, Haldea valeriae valeriae,* and *Lampropeltis calligaster.*

Forms that are typical of the Carolinian biotic province to the north include: *Desmognathus fuscus fuscus, Plethodon dorsalis dorsalis, Pseudotriton ruber ruber, Bufo woodhousei fowleri, Terrapene carolina carolina, Pseudemys scripta troostii, Natrix septemvittata, Carphophis amoenus amoenus, Lampropeltis getulus niger,* and *Ancistrodon contortrix mokeson.*

Forms that are typical of the Austroriparian biotic province to the south include: *Eurycea longicauda guttolineata, Gastrophryne carolinensis carolinensis, Rana pipiens sphenocephala, Kinosternon subrubrum subrubrum, Anolis carolinensis carolinensis, Ophisaurus attenuatus attenuatus, Lygosoma laterale, Natrix erythrogaster flavigaster, Elaphe guttata guttata,* and *Elaphe obsoleta spiloides.*

Finally, two forms represent intergrades between subspecies to the north and to the south. These include: *Diadophis punctatus punc-*

tatus x *edwardsi* x *stictogenys,* and *Coluber constrictor constrictor* x *priapus.*

The abundance of amphibians and reptiles on this small tract of undisturbed land is indeed striking. Thirty-nine species of amphibians and reptiles have been recorded from about 60 acres, as contrasted with a list of only 26 from an entire county in northern Illinois (Olson, 1956). Certainly this speaks favorably for the retention of Natural Areas.

LITERATURE CITED

Carr, Archie F. 1952. Handbook of turtles. Cornell Univ. Press: 1-542.

Conant, Roger et al. 1956. Common names for North American amphibians and reptiles. Copeia (3): 172-185.

Conant, Roger. 1958. A field guide to reptiles and amphibians. Riverside Press: 1-336.

Harper, Roland M. 1928. Economic botany of Alabama. Geol. Surv. of Alabama 9 (2): 1-357.

———1943. Forests of Alabama. Geol. Surv. of Alabama. 10: 1-230.

Olson, R. E. 1956. The amphibians and reptiles of Winnebago County, Illinois. Copeia (3): 188-191.

Pitelka, Frank A. 1941. Distribution of birds in relation to major biotic communities. Amer. Midl. Nat. 25: 113-137.

Schmidt, Karl P. 1953. A check list of North American amphibians and reptiles. Univ. Chicago Press: 1-280.

Relation of Springs to Thrust Faults in Calhoun County, Alabama*

J. C. Warman
U. S. Geological Survey, University, Alabama

L. V. Causey
U. S. Geological Survey, Anniston

INTRODUCTION

A study of 148 springs in Calhoun County, Alabama, was made during 1956-59 as a part of the ground-water investigation by the U. S. Geological Survey in cooperation with the Calhoun County Board of Commissioners, the city of Anniston, and the Geological Survey of Alabama. The purpose of the investigation was to determine the occurrence, quantity, quality, and availability of ground water in the county. This paper describes the relation of springs to the structural geology in Calhoun County. The hydrologic character

*Prepared in cooperation with Calhoun County and the city of Anniston, Alabama, and the Geological Survey of Alabama. Publication authorized by the Director, U. S. Geological Survey.

and geologic setting of the largest spring in the county are compared with those of springs of similar size in Colbert and Madison Counties in northern Alabama. This study was made under the supervision of

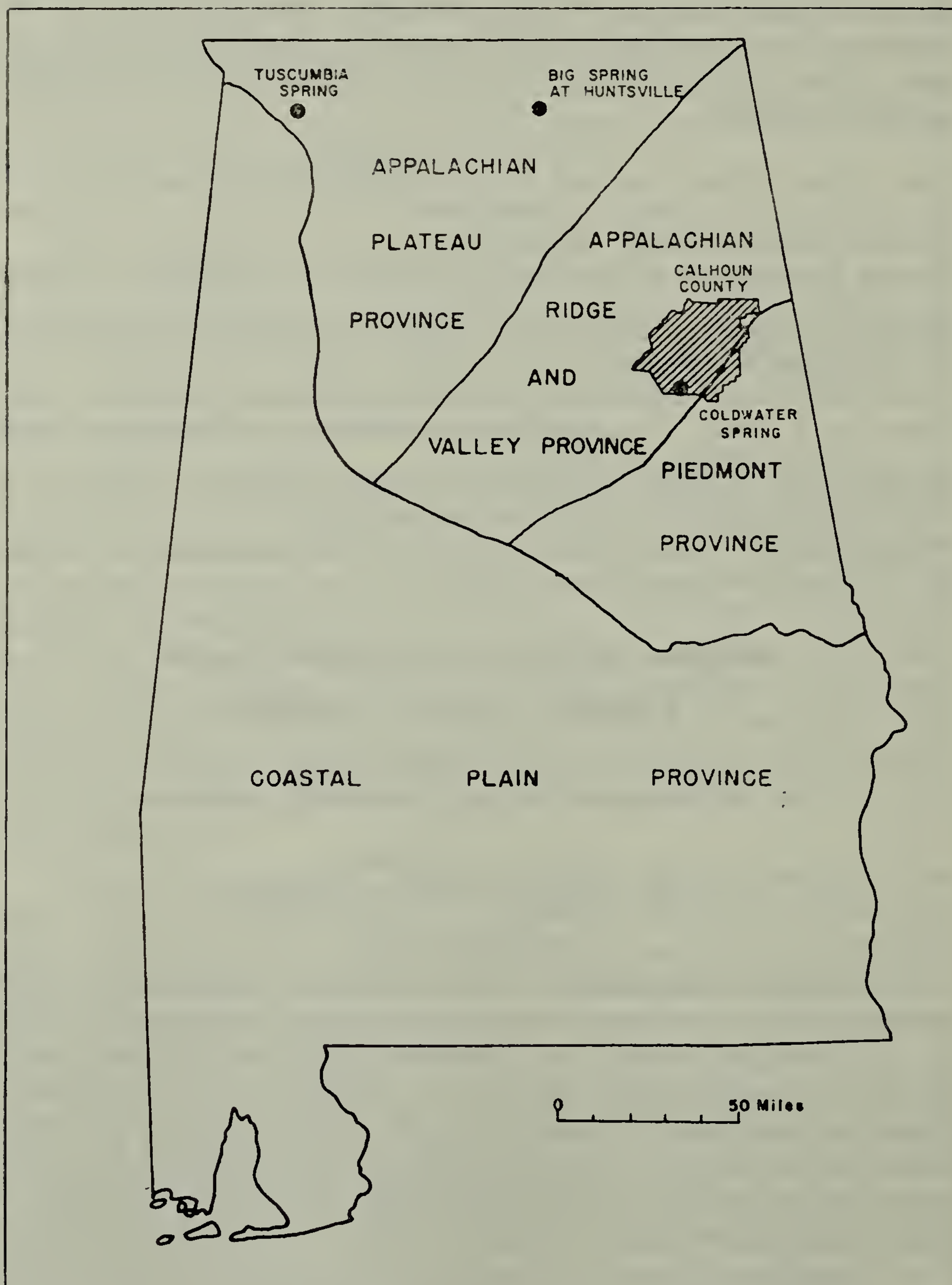


Figure 1. Index map of Alabama showing area covered by this report, physiographic provinces, and location of springs described.

W. J. Powell, district geologist, Ground Water Branch, U. S. Geological Survey, University, Alabama.

GEOLOGIC SETTING

Calhoun County is in northeastern Alabama, and the stratigraphic and structural relationships of the rocks throughout most of the county are typical of the Ridge and Valley physiographic province (Fig. 1). Consolidated rocks that range in age from Precam-

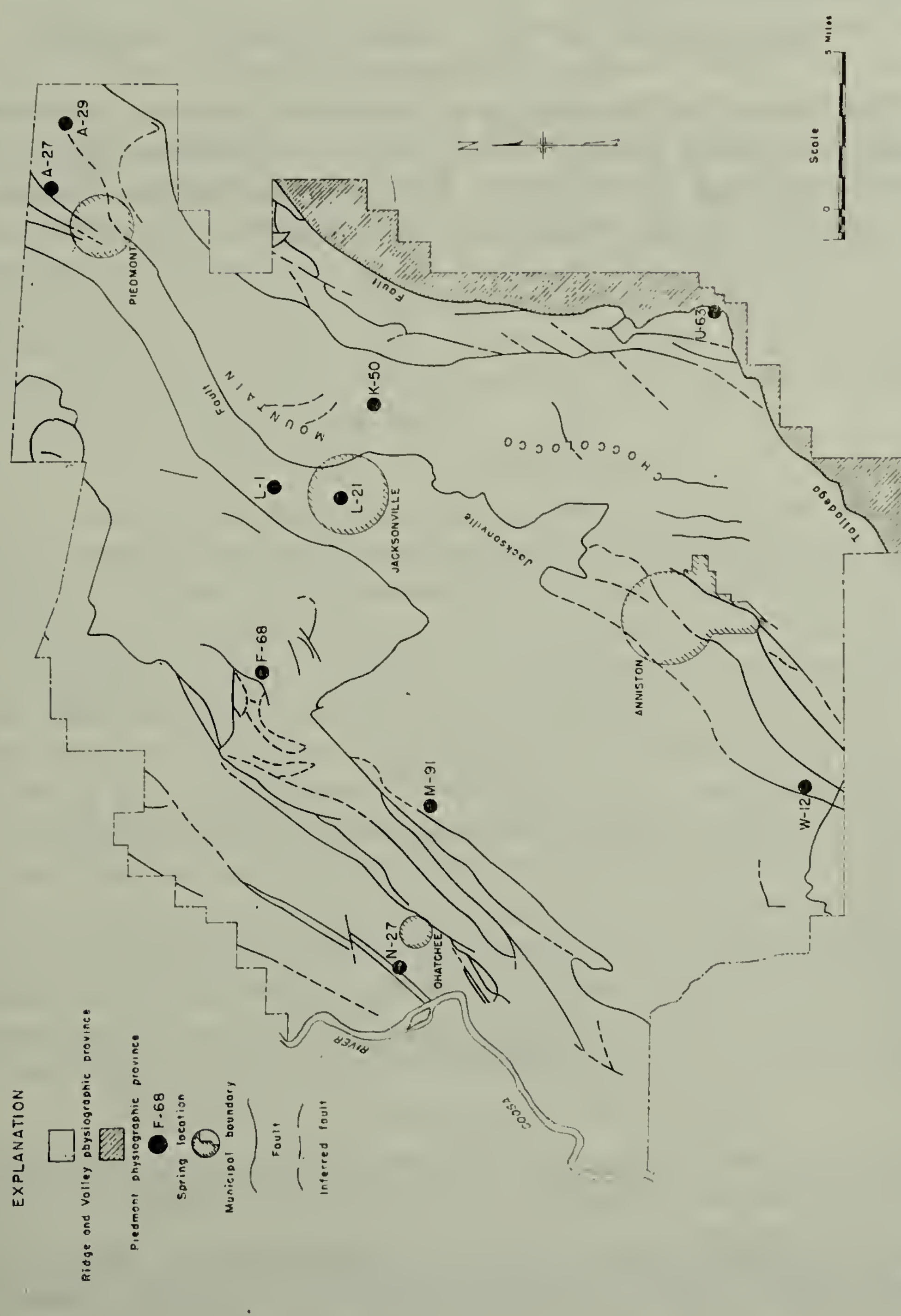


Figure 2.- Map of Calhoun County, Ala., showing location of faults and springs.

brian to Pennsylvanian have been sharply folded into northeastward-trending synclines and anticlines complicated by thrust faults that dip southeastward. The thrust faults are the predominating structural features (Fig. 2), and they form reservoirs and conduits along which ground water from deep or distant sources reaches the surface. Many springs in Calhoun County are located along the trace of the thrust faults and have relatively uniform discharges. The yields of these springs are larger than would be expected if they were recharged locally.

COMPARISON OF THE THREE LARGEST SPRINGS IN NORTHERN ALABAMA

The three largest springs in northern Alabama are Coldwater Spring in Calhoun County (W-12, Fig. 2), Tuscumbia Spring in Colbert County, and Big Spring at Huntsville in Madison County (Fig. 1). Coldwater Spring flows from the brecciated zone of the Jackson-

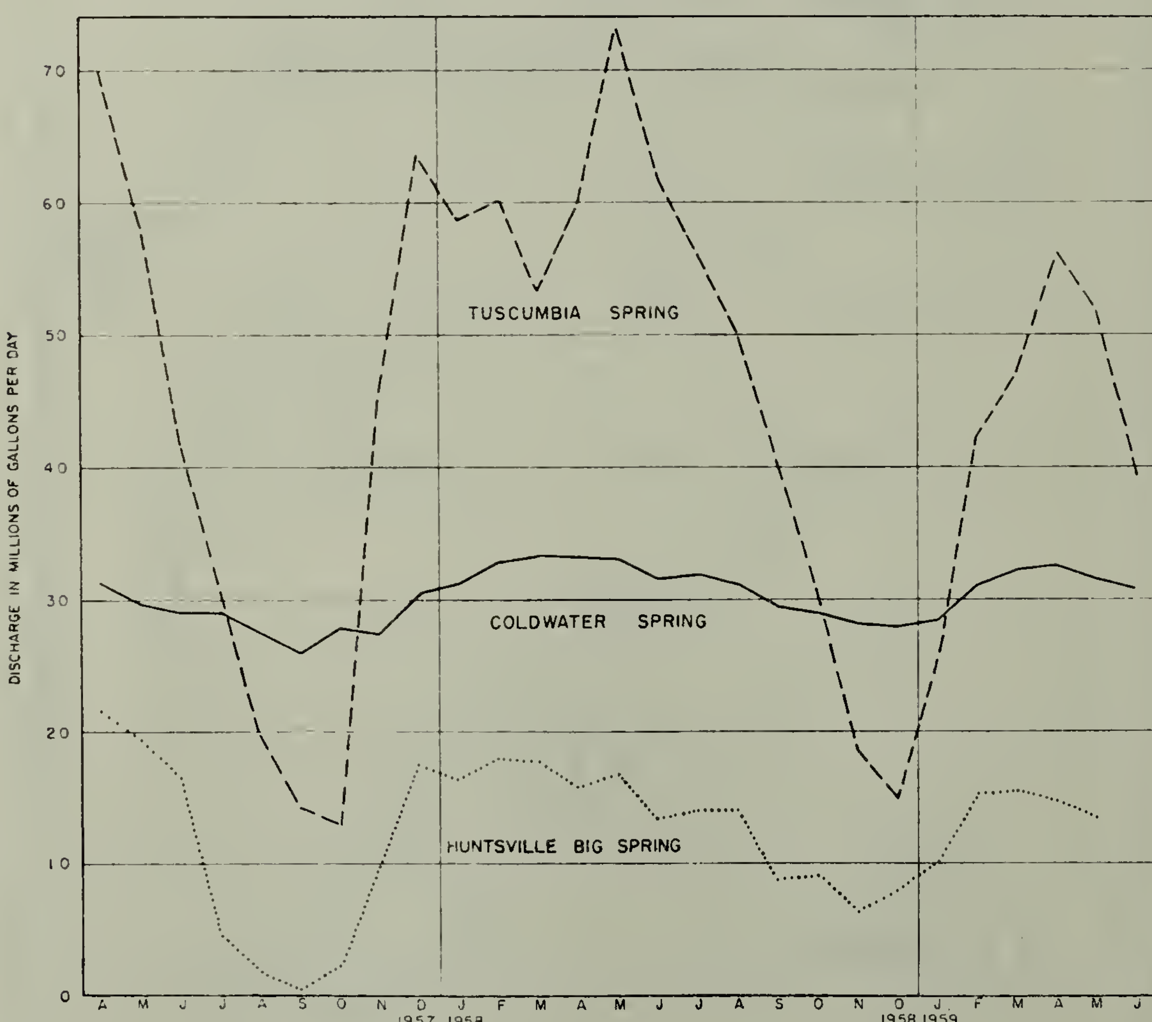


Figure 3.—Monthly average discharge of Coldwater Spring southwest of Anniston, Calhoun County; Tuscumbia Spring at Tuscumbia, Colbert County; and Big Spring at Huntsville, Madison County, Alabama.

ville fault and is the largest and most utilized spring in Calhoun County. In terms of maximum potential development as defined by minimum flow, Coldwater Spring is the largest spring in northern Alabama. In April, 1957, the Surface Water Branch of the U. S. Geological Survey installed a continuous recorder on the spring, and from April, 1957, to June, 1959, the average discharge was 32 mgd (million gallons per day) or 22,000 gpm (gallons per minute). Discharge data for this period obtained from the recorder measurements are summarized in Fig. 3, together with similar data for Tuscumbia Spring and for Big Spring at Huntsville. The average daily discharge of Tuscumbia Spring was 44.2 mgd, and that of Big Spring at Huntsville was 12.6 mgd. Both these springs flow from relatively shallow solution channels in the Tuscumbia limestone of Mississippian age. The seasonal variation of discharge of these two springs is very large, as is characteristic of limestone springs. Recharge to these springs is derived principally from rainfall, which moves rapidly through sinkholes and well-developed solution channels in the limestone beds. In comparison, the seasonal variation in the discharge of Coldwater Spring is small because of the stable source of ground water along the Jacksonville fault.

VARIABILITY OF DISCHARGE

The variability of spring discharge may be expressed quantitatively as a ratio of the range in discharge to the average discharge: $V=100(a-b)/c$, where V is the variability, in per cent, a is the maximum discharge, b is the minimum discharge, and c is the average discharge (Meinzer, 1923b, p. 53-54). During the period April, 1957, to June, 1959, included in the hydrographs in Fig. 3 which show the monthly average discharges, the variability of Coldwater Spring was 30 per cent, the variability of Tuscumbia Spring was 200 per cent, and the variability of Big Spring at Huntsville was 180 per cent.

In addition to the discharge data recorded for Coldwater Spring, periodic measurements of the discharges of 11 other springs in Calhoun County were made from December, 1957, to September, 1959. The discharge measurements of three of these springs were omitted from this report because they included surface runoff. The locations of the remaining eight springs, along with N-27, are shown in Fig. 2.

RELATION OF VARIABILITY TO SOURCE

Germania Spring (L-1) and Big Spring at Jacksonville (L-21) discharge an average of 2,000 and 1,150 gpm, respectively, from limestone beds in the Conasauga formation of Cambrian age. The Conasauga in the area around Jacksonville is known to contain caverns and well-developed solution channels which follow joint sys-

stems in the limestone beds. If these two springs were typical limestone springs, their variabilities would be about 200 to 250 per cent —that is, similar to the variabilities of Tuscumbia Spring and Big Spring at Huntsville. However, the variability of Germania Spring is only 55 per cent, and that of Big Spring at Jacksonville is only 75 per cent. The thrust fault west of these springs does not function as an aquifer, as indicated by a lack of springs along the trace of the fault in the immediate area and to the north. However, there are several large springs to the east which discharge along the trace of the Jacksonville fault. It is probable that the brecciated zone of the Jacksonville fault serves as an aquifier to supply large, relatively stable amounts of ground water along the east edge of the outcrop of the Conasauga formation. Ground water from the fault zone apparently flows through solution channels in the limestone beds to discharge with low variability at Germania Spring and Big Spring at Jacksonville.

Whites Gap Spring (K-50) is on the eastern slope of Choccolocco Mountain about 200 feet above the floor of the valley. In other parts of Calhoun County springs that are similarly located in topographically high areas have low discharges, generally about 10 gpm. however, the average flow of Whites Gap Spring is about 400 gpm. No attempt is made in Fig. 2 to plot the numerous subsidiary faults which cut the Weisner formation throughout the length of Choccolocco Mountain. However, the presence of these faults, their intersection at depth with the Jacksonville fault, and their function as conduits for deep-seated ground water moving upward to discharge at Whites Gap Spring are indicated by the high average discharge and the low variability of 36 per cent calculated for the spring.

McCullars Spring (M-91) flows at an average rate of 2,270 gpm from Cambrian and Ordovician dolomites. The large flow and a variability of 61 per cent indicate the source of ground water to be in the major thrust fault west of the spring.

Seven Springs (F-68) has an average discharge of 2,270 gpm and flows directly from a fault between the Newala limestone of Ordovician age and the Cambrian and Ordovician dolomites. The variability of the spring is 41 per cent.

Smart Spring (A-27) has an average discharge of 340 gpm and flows from the Rome formation of Cambrian age. The large flow of Smart Spring and its variability of 72 per cent suggest that the water flows from the thrust-fault zone that separates the Rome from the Conasauga west of the spring. In other areas of Calhoun County where thrust faults are absent the Rome yields very small amounts

of water to springs, and the limestone beds in the Conasauga yield highly variable quantities of water to springs.

Smith Spring (A-29), which has an average discharge of 165 gpm, issues from the Conasauga formation at a point near the contact of the overlying Cambrian and Ordovician dolomites. In the area around the spring these dolomites weather to a sandy soil containing abundant chert gravel. This type of soil has a high permeability; therefore, the discharge of the spring fluctuates directly with both the seasonal and local variation in recharge derived from rainfall. The variability of Smith Spring is 177 per cent.

Talley Spring (U-63), which has an average discharge of 470 gpm, flows from the Shady dolomite of Cambrian age. Although the spring is located near the Talladega fault (Fig. 2), it is believed to receive little recharge from ground water moving through the fault zone. There are no other large springs along the Talladega fault in Calhoun County. The area east of the fault is in the Piedmont physiographic province and is underlain by the Talladega slate. This formation yields only small amounts of water to springs and wells. Gouge derived from the sericitic slate in the Talladega may have filled any openings originally developed in the fault zone, thus reducing the permeability. The limestone and dolomitic limestone of the Shady furnish abundant supplies of water through well-developed solution channels to springs and wells. Thus, as indicated by its relatively high variability of 130 per cent, Talley Spring is probably similar in hydrologic character and geologic setting to Tuscumbia Spring and Big Spring at Huntsville.

FLUORIDE IN GROUND WATER

Seventeen springs were selected as being representative of the principal aquifers in the county, and chemical analyses were made of water from these springs. All these analyses reported 0.1 to 0.2 ppm (part per million) of flouride, whereas analyses of water collected from 13 drilled wells reported flouride in only two samples. One of the wells yielding flouride is drilled in broken rock in a fault zone. The subsurface geology at the site of the other well is uncertain. The presence of flouride in all the springs sampled in Calhoun County, the relation of the springs to faults, and the absence of fluoride in detectable amounts in water from drilled wells—except in two wells, one known to be finished in a fault zone—suggest that the fluoride is restricted to ground water flowing through thrust-fault zones. The source of the fluoride may be at depth in the fault zones, or may be where the flouride is dissolved in the ground water and then moves long distances through the conduits formed by the fault zones.

ECONOMIC IMPORTANCE OF SPRINGS

The availability of large quantities of ground water from springs has been an important factor in the development of Calhoun County. Anniston, Jacksonville, and Ohatchee have developed their municipal water supplies from Coldwater (W-12), Big (L-21), and Winn (N-27) Springs, respectively. In addition to the area within the city limits, the Anniston Water Department supplies the adjacent towns of Blue Mountain and Oxford, military installations at Fort McClellan and the Anniston Ordnance Depot, and several suburban areas to make a total population of about 54,000 using ground water from Coldwater Spring. Piedmont obtained its municipal water supply from a spring within the town limits until 1954, when increasing demands on the municipal water system, concurrent with a prolonged drought, forced the city to develop another source of water.

About 80 per cent of the 148 springs inventoried in the county are used for domestic, farm, stock, recreational, industrial, and municipal supplies. The minimum total discharge of these springs exceeds 90 mgd. Many of the springs either are not utilized or are only partially developed. Thus, at many favorable locations in the county, an abundant supply of water is readily available from springs for further industrial and economic growth.

ACKNOWLEDGEMENTS

Mr. James E. Standridge, manager of the Anniston Water Department, and Mr. Hoyt B. Arnett, superintendent of the Water and Gas Board in Jacksonville, have been very helpful in making available records of daily municipal pumpage.

SELECTED BIBLIOGRAPHY

1. Adams, G. I., Butts, Charles, Stephenson, L. W., and Cooke, C. Wythe. Geology of Alabama. Alabama Geol. Survey Spec. Rept. 14, 312 p. 1926
2. Fenneman, N. M. Physiography of eastern United States. New York, McGraw-Hill, 714 p. 1938.
3. Johnston, W. D., Jr. Ground water in the Paleozoic rocks of northern Alabama. Alabama Geol. Survey Spec. Rept. 16, pt. 1, 414 p.; pt. 2, 48 well and spring tables. 1933.
4. McCalley, Henry. The Coosa Valley region, pt. 2 of The valley regions of Alabama. Alabama Geol. Survey Spec. Rept. 9, 862 p. 1897.
5. Meinzer, O. E. The occurrence of ground water in the United States, with a discussion of principles. U. S. Geol. Survey Water-Supply Paper 489, 321 p. 1923a.
6. Meinzer, O. E. Outline of ground-water hydrology, with definitions. U. S. Geol. Survey Water-Supply Paper 494, 71 p. 1923b.

Weather and the Potato Crop

Arthur R. Long

U. S. Weather Bureau, Montgomery

HISTORICAL

Origin of the potato is lost in antiquity. When the Spaniards invaded South America in 1524 they found a large number of varieties and species under cultivation, the tubers of which were used as a common article of food by the natives. It is more or less conjecture as to where these varieties and species originated. They seem to be native to the American continents, since their relatives are still found growing wild in elevated regions extending from the southwestern part of the United States to the southern part of South America. All species seem to require a cool climate. They are found growing in regions near the equator at high elevations, but none is known to grow under tropical conditions.

Little is known of the introduction of the domesticated potato into North America. It is generally believed that the English colonists of Virginia and Carolina obtained the potato from the Spaniards or from other travelers. Apparently the most authentic report shows that potatoes were first grown in the United States at Londenderry, New Hampshire, in 1719, from stock brought over from Ireland. For this reason, perhaps, the potato has been called the "Irish" potato.

A famine was caused in Ireland in 1739, due to a "deep frost" which seriously curtailed the potato crop. In 1846 Ireland was suddenly confronted by the "Great Famine." The potato crop, which was as indispensable in Ireland as the rice crop is in India, failed over the entire country as a result of the blight.

In volume of fresh product, the potato ranks first among the world's most important food crops. It is grown in almost every country in the world and in each of the 50 states of the Union. It is an excellent food and it may be prepared in a variety of ways for human consumption.

FAVORABLE CLIMATOLOGICAL CONDITIONS

Length of day. Long, warm days are most suitable for the growth of tops in the potato. Shorter days are more efficient for tuber formation. Conditions most suitable for maximum tuber yields, therefore, are long days which favor large top growth, followed by short days to stimulate tuber formation.

Temperature. Heat necrosis, or high-temperature injury to the

tuber, has been noted especially on sandy soils where early crops mature during hot weather.

Freezing injury to the developing potato plant is most common in the South, where the crop is grown during the winter or early spring. Damage may range from a nipping of the leaves to a killing back of the plant to the surface of the soil.

In the North, the late crop season is often cut short by frosts killing the vines prematurely. Occasional losses also occur from unseasonably hard freezes that injure the tubers in the soil before the crop is harvested, and freezing continues to be a hazard throughout harvest, storage, and transit.

Temperature affects tuber formation and yields of potatoes by influencing both the rate of photosynthesis and the rate of respiration. Optimum soil temperatures for tuber formation are from about 59° to 64° F. Usually no tubers are formed when the soil temperature is above 84° F.

Rainfall. Potatoes are sensitive to soil moisture from the time of planting until the tubers are fully formed. In many areas there is a direct correlation between rainfall and yield of potatoes. This is true where rainfall is low and growth of foliage and tubers suffers from lack of moisture. Conversely, in areas or seasons where rainfall is excessive—interfering with cultivation, waterlogging the soil, etc. —an increase in rainfall may be associated with reduction in yield.

THE ALABAMA POTATO CROP

Two crops of potatoes may be grown in Alabama each year, one in the spring and the other in the fall; the former being the more important crop.

Baldwin, Escambia, and Mobile, three southwest Alabama counties, constitute the commercial early Irish potato belt in Alabama. The main potato crop in this area is usually planted between January 25 and February 10, although some planting is done as early as December 28 in the southern part of Baldwin County. Potatoes planted between January 25 and February 20 should normally be dug between April 25 and June 10. These potatoes are a perishable crop when harvested. They are of high quality when dug, but must be given proper and careful handling if this quality is to be preserved until the consumer market is reached.

A glance at Table 1 shows that for the period 1949-1958, the 1952 Alabama potato crop was outstanding, with an estimated total value of $9,836,000. The three southwestern counties produced 71 per cent of this amount.

Table 1. Alabama Irish Potato Statistics, 1949-1958

Year	Baldwin, Escambia, and Mobile Counties			Remainder of State		
	Harvested	Yield Per Acre	Value of Total Production	Harvested	Yield Per Acre	Value of Total Production
	Acres	Bushels	Dollars	Acres	Bushels	Dollars
1949	13,700	137	3,302,000	17,300	72	2,478,000
1950	16,200	158	3,355,000	16,200	73	1,455,000
1951	19,400	170	3,899,000	12,700	80	1,281,000
1952	19,000	172	6,967,000	12,000	82	2,869,000
1953	28,300	197	3,926,000	11,000	65	837,000
1954	18,400	178	4,686,000	12,000	83	1,506,000
1955	16,700	45	1,772,000	9,800	75	1,072,000
1956	15,400	187	6,848,000	8,500	83	1,904,000
1957	17,000	208	3,782,000	9,400	83	1,189,000
1958	17,000	217	4,985,000	9,400	80	1,021,000
AVG.	18,110	167	4,352,200	11,830	78	1,561,200

For the 50-year period, 1909-1958, the lowest state average production per acre was 56 bushels, in 1955, and the highest was 168 bushels, in 1958. Unfortunately, separate statistics were not kept on production in the three-county area prior to 1949. During the 10-year period, 1949-1958, the average state production per acre was 133 bushels, while in the three-county area it was 167 bushels. During this period the greatest three-county production was *217* bushels per acre in *1958*, and the least was *45* bushels in *1955*.

Low production in 1955 was due to the fact that one of the most damaging out-of-season cold waves in many years hit Alabama during the latter part of March of that year. The lowest temperatures of record for so late in the season were reported at many stations on March 27. Low temperatures in the three-county area ranged from 23° F. at Brewton to 26° F. at Fairhope. This late cold wave also explains why, out of 25,600 acres of potatoes planted, only 16,700 were harvested in 1955.

The upward trend in yields is caused by a shift in acreage to better potato land, improved production practices, and generally favorable conditions. Recent developments of improved insecticides and fungicides have contributed to the relatively high yields attained during the last decade or two. In the three-county area of southwestern Alabama, yield per acre increased 58 per cent from 1949 to 1958.

Fall potatoes are usually planted in north Alabama from July 20 to August 1; in central Alabama from August 10 to 20; and in

south Alabama from August 20 to September 1. The fall crop of potatoes is more difficult to grow than the spring crop, and yields are generally much lower. It is more difficult to obtain stands from summer-planted than from spring-planted potatoes; temperatures and rainfall during the growing period are often unsatisfactory; and many soils are not moist enough in late summer and fall to produce a good yield. The importance of the fall potato crop lies in the fact that the crop may be planted after many other crops have been harvested, thus producing two crops per year. Moreover, the potatoes provide an additional source of food as well as revenue during the fall and winter months.

ALABAMA WEATHER

Temperature. Records from ten temperature stations in the three-county area show an average temperature of 62.6° F., January-May, for the period 1949-1958. This 10-year temperature record includes the coldest winter of record, 1957-1958, with an average temperature of 47.8° F., December-February. Despite the coldest winter in some 75 years of complete state weather records, a record yield of 217 bushels of potatoes per acre was produced the following spring. This is attributed to the fact that although the weather was abnormally cold no damaging freezes occurred during the spring. In addition to this coldest winter of record, the 10-year period included the abnormally late severe freeze during the latter part of March, 1955.

Precipitation. Average precipitation over southwest Alabama, January-May, averaged 23.47 inches during the 10-year period. During the period 1949-1958, the greatest January-May average precipitation was 30.85 inches in 1949; the least was 11.96 inches in 1954.

Despite the fact that 1954 was the driest year of record in Alabama, and the driest season in the southwest Alabama potato belt, a high yield of 178 bushels of potatoes per acre was produced that year.

This area, situated near the Gulf Coast, can depend on sufficient precipitation for the production of potatoes practically every year.

The West Indian Negro in Panama: Observations on Racial and Cultural Pressures

Marjorie B. Smith
Florida State University, Tallahassee

It would be misleading to speak exclusively of racial pressures in the Republic of Panama, where the social consequences of racial differences are minimal but the results of class and cultural differences are considerable. There is no segregation, as is known in the United States. There is, however, a problem of assimilation and of the fusion of cultures in a society where biological amalgamation is extensive. The population of Panama is approximately 80 per cent Negro and mestizo, the latter largely a mixture of Negro and white but with some admixture of indigenous Indian (1). The assimilation problem is manifested most obviously in the interrelations of the two distinct negroid groups of the Republic.

The negroid population can be divided into two basic subdivisions, mainly on the basis of historical chronology and provenience. The first group comprises the descendants of the colonial Negroes, brought to Panama as slaves directly from Africa, beginning in 1517. The second group is made up of Negroes from Jamaica, Martinique, and other islands of the West Indies. Although some were brought in as far back as the late Spanish colonial period, the greatest migration occurred early in this century during the Canal construction days, and a minor amount of immigration continues up to the present.

In the United States there is only one main term, Negro, in general use to identify the racial group that is not white (exclusive of the Asian or Indian). Panama's terminology is more varied. The West Indians are called *negros* or, derogatorily, *chombos* by the Hispanicized native Panamanians. West Indians usually designate themselves by the name of the place from which they came—for example, *jamaicanos* or *martiniquenos*. The North American residents of the Canal Zone tend to lump all West Indians under the term "Jamaicans." The common language of Panama has a special word for the descendants of Panama's colonial Negroes. They are spoken of as *morenos* to distinguish them from the *negros* (West Indians). The Negro-Indian is called *zambo*.

For simplicity and clarity, a pair of arbitrary labels is adopted for the two main groupings of Negroes. Through the remainder of the paper, Negroes who derive from the Negroes of colonial Panama

are indicated by PN. Negroes who migrated from the West Indies into Panama or whose ancestors were such migrants are referred to as WN. Both groups have essentially the same range of physical traits. In fact, when WN's speak fluent Spanish, as some of them do, there is no ready way to distinguish them from PN's. Still, important and persistent social and cultural differences separate them.

Today the PN considers himself to be a full Panamanian, regardless of his degree of mixture or the nature of the pigmentation. He is a completely acculturated and Hispanicized member of the population, and is so accepted by long-established Panamanians of every social class.

In contrast, the WN is a marginal man in Panama. As defined by Park, a marginal man is, " . . . an incidental product of a process of acculturation, such as inevitably ensues when peoples of different cultures and different races come together to carry on a common life." He "lives in two societies and in two not merely different but antagonistic cultures" (2). Taking liberties with Park's definition in relation to the WN, we might add the words "and classes" to the foregoing.

The WN in Panama is many things, depending upon where he lives and where he works, but always he remains a WN and a foreigner in the eyes of the non-WN's, be they Panamanians of any class, or North Americans. The WN lives not just in two societies, as in Park's definition, but in several societies. He left a society in which he was already a marginal man and moved into a society where his marginality is multiple. On the islands, he was on the fringe of a dominant white society, for the most part British, with distinctions based largely on color. In Panama, he is marginal, not only to a basically non-Negro dominant middle and upper class, but also to a group of his own color though not of his own culture. In addition, he finds himself on the edge of the U. S.-dominated culture of the Canal Zone.

The WN's position in the social system of Panama shows many paradoxes, not the least of which is the coexistence of both acceptance and rejection. This is caused largely by factors of his own making. While he is legally a citizen of the Republic, he is at the same time rejected as a full citizen for reasons that he himself provides.

The first and perhaps most important reason for his rejection is his reluctance or refusal to speak Spanish. The majority of WN's migrated from English-speaking islands, with English as their native tongue. Moreover, most of them were brought to Panama by the United States government to work on the construction of the Canal under English-speaking employers, or they have migrated more re-

cently to seek jobs in the Zone where their knowledge of English was welcome. The incentive to learn Spanish was lacking, and most of them learned only as much as was necessary for essential communication in their Spanish-speaking adopted country. As more and more migrated from the islands, they tended to form enclaves within the Republic and, keeping to their own cultural and social group, continued to have little use for any language other than English.

The situation has been reinforced continually by the presence of the Canal Zone and its special opportunities for employment. Under English-speaking bosses, unskilled and semi-skilled laboring jobs in the operation of the Canal necessitate, for the most part, an acquaintance with English. The lowest position in a Canal Company office requires a relative fluency in English. And the WN woman finds her knowledge of English an "open sesame" to domestic work in the Canal Zone, due to the disinclination of many North American housewives to learn Spanish.

The repercussions of all this are obvious. The national language of Panama *is* Spanish. In the eyes of most Panamanians, a failure to learn Spanish implies a lack of interest in the country and the culture as a whole. Language also has an economic effect which touches people on a tender spot. Preference is often given to WN's for jobs in the Canal Zone which long-established Spanish-speaking Panamanians feel should rightfully be theirs. The preference is as true for labor crews and domestic help as for the office jobs. Since jobs with the Panama Canal Company are the best-paying jobs on the Isthmus—generally far higher than equivalent jobs in the Republic—the resentment is well founded.

The reaction is most marked among Panamanians on the same economic level as WN's. It is the PN's who compete for the openings as maids, yardboys, ditchdiggers, road crews, dock hands, and similar jobs. It has been noted that the strongest prejudice against the WN is held by PN's. The PN sees the WN as an interloper, as a competitor, and as a foreigner—in spite of the latter's equal legal citizenship.

Citizenship itself is a nebulous privilege that the WN can not rely on with certainty or with any sense of security. It has always been precarious. Citizenship was withdrawn from WN's in 1941 during the presidency of an extreme racist. Citizenship was restored in 1946, but it is still hedged about by numerous discriminatory laws. This reference to the status of the WN as a citizen brings us to the second reason for his slow assimilation, and here he is seen most clearly as a marginal man in the light of Park's definition.

The WN is accused, and often rightfully, of withholding his full loyalty to the Republic as a citizen. This was particularly true of the earlier immigrant generation, for its members felt much closer ties to the islands and to the British government than to the new country to which they had come. In the face of the lack of acceptance they met in Panama, they continued to consider the islands as the home country and as the place to which they would return "some day." Few, however, do return.

The lack of a permanent place in the Canal Zone, where some 4,500 WN's are only temporary residents for the duration of their employment by the Company, generates the same attitude. Thus with strong initial loyalty to his home island, lack of permanence in the Canal Zone, and manifested rejection in the Republic, the WN withdraws into a peculiar loyalty to his own kind. This increases his feeling of isolation and fosters solidarity among WN's. At the same time, his withdrawal augments the feeling of full-fledged Panamanians that he is an outsider.

It is only within the second and third generation WN's of today that a sense of identity with the Republic is emerging. This is particularly evident in a recent development on the political scene, with the creation of the Independent Afro-Panamanian Association. The organization, composed chiefly of second-generation WN's, was formed during the presidential election campaign of 1960. It declared that it would support any political party which nominated at least four Panamanians of West Indian origin as candidates for the National Assembly. This marked the first time that the WN's had united in an all-out effort to organize the WN vote. The association maintained that it could deliver 15,000 votes in the May elections, from some 400,000 eligible voters in the Republic (1). The new feeling of identity as citizens was also expressed in political advertisements in which candidates displayed the slogan "All Panamanians."

It has not been possible to ascertain fully the effect of the new association on PN's. It is probably safe to assume that their profound linguistic and cultural differences from the WN sufficed to keep them out of the association and to maintain their traditional identification with white Spanish-speaking Panamanians. It may also be reasonable to think that the formation of the association may increase the schism between the WN and the other peoples of the Republic, especially the PN's.

The name of the new group, the Independent *Afro*-Panamanian Association, indicates a growing awareness on the part of the WN of the importance of the Negro world. This is not surprising in view

of the current trend for Negroes everywhere to look with pride on the achievements of Negroes in Africa. A recent column in the *Panama Tribune,* an English-language newspaper published by and for WN's, was devoted to the independence movement in British Honduras. It contained the statement, "Another Negro nation in the Americas can not help but add to the heightening prestige of the black man on the international horizon" (3).

Here may be a symptom of the insecurity of the WN in Panama. He becomes conscious of himself as a *Negro,* in contrast to the almost complete lack of such consciousness in the PN. The PN holds a sure place as a citizen of Panama and as a member of the Panamanian social system; the WN lacks this security and is seeking his identity elsewhere, perhaps in the world picture rather than in the national picture of the country of which he is a marginal person.

On a personal level, verbal brickbats are thrown in both directions between the PN's and WN's. The PN will scorn one who works hard, and say, "He works like a *chombo*" (4). At the same time he will resent the industriousness that enables the WN to compete more successfully. The WN, on the other hand, considers the PN unambitious and lazy and feels that he himself earns the right to the better jobs through his hard work.

Both sides accuse the other of dishonesty. Nor is the allegation limited to these two groups alone. In any gathering of persons of what we might call the "employer" class — Panamanian or North American—there will often be a discussion over the relative honesty and worth of WN versus PN employees. Views on the subject reflect, quite interestingly, the general attitudes and even the nationality of the employers. A Canal Zone housewife will maintain stoutly the superiority of a WN maid for her complete honesty, hard work, and (although this is usually not mentioned) her ability to speak English. The upper-class Panamanian woman will, on the other hand, reinforce the PN's position by refusing to employ a "lazy dishonest *negro* who can't even speak decent Spanish." Categorizing and stereotyping the two groups this way further increases the distance between them and is reflected in the attitudes of the workers themselves. PN and WN maids, working side by side in multiple dwelling units, engage in frequent minor feuds. Either will report to a sympathetic mistress on the shortcoming of the other, almost invariably adding, "but what can you expect from a *negra* (or a *panamena*)!"

Still other cultural differences separate WN's and PN's. The largely Protestant WN's deeply religious practices and attitudes are opposed to the PN's preponderance of diluted Catholicism. The WN

is ambitious to better himself, while the PN is inclined to let each day take care of itself. The WN's have many exclusive clubs and organizations which have almost no counterparts among the PN's. All of these things can cause friction, provoke derision, and sustain the wide gulf that lies between the WN and PN.

It has been possible only to outline here some of the basic differences affecting the assimilation process of the West Indian into the culture of Panama. We have viewed the situation mainly on the level of assimilation of the two identifiable negroid groups. In spite of everything that has been said, the gulf between them is not as wide as it used to be. Panama, like other Latin American countries, is a young nation in the making, a society in transition. The assimilation of the variety of cultures to form a single common culture is in process, even in the face of important differences in language, religion, and other cultural factors.

People of all classes and cultures took part in the Republic's recent demonstrations against the United States, which, although mainly political, were indicative of the increasing solidarity of Panamanian society as an entity. Without condoning these actions, it is still possible to recognize them as healthy signs in the assimilation of Panama's cultures. For when dissimilar peoples unite on a common front, internal barriers are weakened. There is evidence of a new awareness of the desirability of assimilation and a growing willingness of all groups to share in the task of forging a unified national culture.

REFERENCES

1. *New York Times,* (Feb. 23, 1960).
2. Robert E. Park, in E. V. Stonequist, *The Marginal Man* (Charles Scribner's Sons, New York, 1937), p. xviii.
3. Jack Jamieson, "Turnovers," *Panama Tribune* (Panama, Feb. 13, 1960), p. 10.
4. John and Mavis Biesanz, *The People of Panama* (Columbia University Press, New York, 1955), p. 223.

The Intellectual Power of the Sociological Perspective

Chester W. Hartwig
Auburn University

"Step forward, ladies and gentlemen! Don't push! Don't shove! Don't trample one another! But do step forward to see and hear of this latest wonder! Here is something for all—for man, for woman, for child; for young, for old; for all!" In the guise of the nostrum peddler of an earlier era I come before you to introduce my topic: the intellectual power of the sociological perspective. Whether this medicine I peddle is as potent as was, proverbially, that of the familiar American frontier medicine man has yet to be ascertained. The frontiers of the human mind of our day have still to be sold on the virtues of the sociological elixer. But, in all seriousness, I suggest that in the area of the sociologist lies an orientation that all modern disciplinarians—whether in the physical, biological, or social sciences—can utilize to distinct advantage in their own disciplinary areas, and that orientation is the sociological perspective.

Before indicating the nature and then the worth of this perspective, let me suggest why I believe the task I undertake here today is essential and timely. Talcott Parsons has recently and quite correctly written that sociology has " . . . graduated from being the least respectable of the social science disciplines to being the most controversial" (1). It is quite possible that, with your own interests, you may not have noted that the sociologist has gained increased attention in the American setting during the last few years. Just this past year that eminently respectable publication of the business community, *Business Week,* ran an article on the sociologist in industry. Early in 1959 that staid paper, the *Wall Street Journal,* reported that sociologists, among other social scientists, were in current demand in industry. And in *Time* magazines or in our daily papers, you undoubtedly in the last few years have seen mention—some kind, some otherwise—of the sociologist or of the field of sociology. It is, then, in a period when the sociologist is increasingly noticed by an American public that I suggest we consider the virtue of his wares.

There is yet another and more pressing reason for appraising the sociological perspective at this time. We live in a period when men are increasingly disturbed about the world in which they live.

There is no need to go into any detail about the problems men face in our time: the threat of nuclear conflict, the race into space, the fears regarding population developments, the challenge of other social orders, the rise of gaunt, hungry, illiterate masses of humanity in our world, the strains and stresses within our own social system. These problems are familiar enough to the perceptive person of our time; but how are these problems to be resolved satisfactorily if we honestly look beyond our own individual pet (and often petty) solutions? It is the fate of the present-day honest intellectual to dwell on the brink of disaster. The intellectual of our time plays his own game of "brinkmanship." As one of them, Sir Charles Percy Snow, recently stated the West's predicament: "The danger is that we have been brought up to think as though we had all the time in the world. We have very little time. So little that I dare not guess at it" (2). It may only be a disease of the somewhat ordered mind of the intellectual to perceive disaster amid the disorder of the empirical world; but, even if so, it will have to be dealt with for there is little likelihood that man will abandon what is still the best adjustive technique he has discovered to date for coping with his situation. If the situation be such as the intellectual believes—that we do confront immense problems which press for resolution, or "the deluge"—then it is quite appropriate that we look into our intellectual grab-bag of tricks to appraise the possible worth of one of them: the sociological orientation.

It is now my task to indicate the nature of the sociological perspective, which I have claimed has utility in other areas than just the field of the sociologist. With no intent to indicate the dimensions or outline the bounds of the field of sociology, I would suggest that basic to the efforts of the sociologist is his concentration upon human interaction or upon the fact of man's group existence. More specifically, he is concerned with and studies "social action," which is that phase of human behavior which is illuminated by recognition that other human beings have to be resorted to as a means for explaining why the behavior observed is what it is rather than something else. Another way of stating the same thing is to say that the sociologist is concerned with that behavior which we human beings evince which indicates the presence of others in our behavior in some manner or form.

A deceivingly simple illustration of social action might be suggested by my own present behavior. An observer might point to my present talking behavior and offer a ready explanation in terms of the existence of a number of listeners. Were we to press this ob-

server, however, for a more adequate and comprehensive explanation of this talking behavior, his account would become very intricate and would carry him far afield in human cultural history before he could render an accurate and comprehensive explanation as to why I speak the way I do (intonations, words employed, syntax, gestures), why I deal with this topic rather than with others, why others bother to listen to me, and on and on.

This sociological perspective on human behavior, and this behavior's complexity, is rather neatly summarized in the phraseology employed by Gerth and Mills:

> Man is a unique animal species in that he is also an historical development . . . Neither his anatomy nor his psyche fix his destiny. He creates his own destiny as he responds to his experienced situation, and both his situation and his experiences of it are the complicated products of the historical epoch which he enacts (3).

The sociological perspective can be stated simply, by saying, for instance, that the sociologist studies human society. But that simplicity covers a multitude of profundities many of which, at this stage, are very poorly understood and many more of which have yet to be discovered. In sociology the recognition of this state of the discipline—not knowing everything there is to be known about its area of preoccupation—is well appreciated. It is exemplified in the controversy, in recent years, over whether sociology must be content now with minor theoretical formulations for, presumably, it is incapable of formulating more comprehensive theory at this time because so much has yet to be discovered.

It is this dual aspect of the sociological perspective which I would emphasize for you: its simplicity and its profundity. By emphasizing the simple aspect, that it is simply concerned with human interaction, I hope to attract your attention to an orientation which I believe can be useful to you no matter what your disciplinary area; and by emphasizing the profound aspect, that it is concerned with human society, I hope to convey the breadth of this orientation so as to underscore its inclusiveness and at the same time to precaution you as to its intricacies should you seek to apply it in the area of your own concerns.

A few words need to be interjected here to take note of current misunderstandings of sociology, such as the sometimes-heated comments we find in magazines or newspapers or which we hear over radio and TV today. Sociology is a science in pursuit of knowledge. If it grinds any axe, it is the axe of truth. This goal of sociology, knowledge regarding the significance of the social in human behav-

ior, should not be underestimated. Knowledge, and its impact on human living, is not to be belittled. The implications for, and the ramifications in, social life can be many and varied when knowledge about human behavior accumulates; but this is another topic which we cannot here explore. Charges currently heard about sociology dictating Supreme Court decisions, or sociology attempting to radically reform society, only reveal their perpetrator's ignorance of the fact that sociology is but another one of our scientific disciplines actively seeking to discover knowledge.

To acquire a quick guide to the possible utility and ubiquity of the sociological perspective, I can do no better than to recommend some of the symposiums which attempt to summarize principal developments in sociology (4). Were you to glance down the chapter titles of such works, headings such as the following would be found: the sociology of art, the sociology of crime, the sociology of economic and industrial life, the sociology of the family, the sociology of knowledge, the sociology of law, the sociology of literature, the sociology of politics, the sociology of religion, and the sociology of science. There are other headings, but I shall attempt no further listing.

Do not misconstrue this listing of sub-disciplinary areas and interests in sociology as any effort to revive academic jurisdictional disputes of an earlier day. Fortunately, we have long since left that period in our intellectual development. Today we are more concerned with encouraging cooperative efforts in common problematic areas than we are with driving off intruders from neighboring intellectual areas. As John Gillin indicated a few years ago: "Indeed it is entirely possible that, as the problems of a cooperative science of social man become clearer, it will be seen that more rather than fewer specialisms are needed" (5). The intellectual conceits and securities of a little knowledge, possibly, give way to a humbler appreciation of how little has been accomplished and of how far the road of truth-development stretches into the obscurities of the future.

As we have indicated, sociologists and others have been active in many areas in attempting to apply the sociological perspective, and significant achievements have been recorded. It is this type of intellectual achievement to which I would direct your attention in the hope of encouraging others to see the intellectual power or the intellectual productiveness of the sociologist's orientation. It is my hope that others, too, may see some possible application of this perspective in their own intellectual areas.

Possibly you may have thought that I overstretched myself in

claiming at the start of this paper that there was utility for this perspective in all scientific areas, but that claim was stated in all seriousness and with due appreciation of what was implied. As workers in the sociology of knowledge and science have informed us, there are rather close ties to be discerned between scientific developments and the sociocultural setting within which they take place—ties which indicate sociocultural conditioning, if not epistemic determination, of knowledge. Unfortunately, as Bernard Barber has pointed out, in many of our physical and biological scientific areas, when the sociologist attempts to apply his orientation, he labors under severe handicaps (6). As specialization in science persists and intensifies, this will be more generally true of all science, hence the need to encourage other scientists to consider the sociological perspective and the possibility of their utilizing it in their different scientific areas.

The two types of claimed ties between a sociocultural setting and the development of knowledge—no concern can here be given to the problem of the application of knowledge—are my central consideration. The first type of claimed connection—the conditioning of knowledge—is readily perceived when a Darwin suggests the importance of a Malthus' formulation in economics and demography for his own thinking in biology, or when the suggestion is offered that the early interpretation placed on Darwinian thought was tinged by the economic values prevalent in a late nineteenth century industrializing Western society wherein the interpretors dwelled. In the second type of tie—the epistemic connection claimed, and the relativity of knowledge implied—is present in the Marxian heritage and its derivatives, or in the Whorfian anthropo-symbolic hypothesis as yet so inadequately explored. The latter tie is the more fundamental consideration of the two, but both have important things to say about the scientist and his work. As has been pointed out by others, the first claimed connection has found greater acceptance in the American setting, while the European tradition has tended to stress the second (7). This, in itself, is a commentary worthy of investigation.

But, that which I wished to stress today was to suggest that here is an instance of where the scientist, whatever his area, may find a helpful key to the better understanding of his own scientific being and his work. As Philipp Frank, the physicist, in his discussion of the philosophy of science has pointed out:

> Scientists and scientifically minded people in general have often been inclined to say that these "non-scientific" influences upon the acceptance of scientific theories are something which "should not" happen; but since they do happen, it is necessary to understand their status within a logical analysis of science (8).

And, as he writes more broadly:

> New lines of research arise for the scientist who wants to achieve a real understanding of his science. We are guided into the wide field which embraces science as a part of human behavior in general. We may speak of a "sociology of science" or of the "humanistic background of science" if we want to give these new fields a frame of reference in our traditional parlance (9).

There is in the sociological perspective a means whereby the scientist can better appreciate the place, nature, and importance of his scientific work and area in the current sociocultural setting. There is the added possibility that this orientation may also be a means for furthering the development of knowledge in his own scientific area. These are not modest claims for the utility of the sociological perspective. May I encourage you to test their validity by turning to some recent works on sociology. Especially helpful and stimulating will be those in the area of the sociology of knowledge and science, for here you will have the opportunity to sample the bouquet and vintage of this heady elixer, the intellectual power of the sociological perspective.

REFERENCES AND NOTES

1. Talcott Parsons, "Some Problems Confronting Sociology as a Profession," *American Sociological Review,* 24 (August 1959), 553.

2. Sir Charles Percy Snow, "The Conflict of Culture," *Saturday Evening Post,* September 12, 1959, 65.

3. Hans Gerth and C. Wright Mills, *Character and Social Structure* (New York, Harcourt, Brace, 1953), 480.

4. See, for example, Robert K. Merton, Leonard Broom, and Leonard S. Cottrell, Jr., eds., *Sociology Today* (New York, Basic Books, 1959); on Joseph S. Roucek, ed., *Contemporary Sociology* (New York, Philosophical Library, 1958).

5. John Gillin, ed., *For a Science of Social Man* (New York, Macmillan, 1954), 5.

6. Bernard Barber, "The Sociology of Science" in Merton, et al., eds., *Sociology Today,* 227.

7. See H. Otto Dahlke, "The Sociology of Knowledge" in H. E. Barnes, Howard and Frances B. Becker, eds., *Contemporary Sociological Theory* (New York, Appleton-Century, 1940), 69-89; and Robert K. Merton, "Sociology of Knowledge" in Georges Gurvitch and Wilbert E. Moore, eds., *Twentieth Century Sociology* (New York, The Philosophical Library, 1945), 366-405.

8. Philipp Frank, *Philosophy of Science* (Englewood Cliffs, Prentice-Hall, 1957), 355.

9. *Ibid.,* 359.

Biochemical Studies of Toxicity*

I. Microdetermination of Thymol in Aqueous Solution

A. A. Walker

University of Alabama Birmingham Center

A new ultraviolet spectrophotometric method for the analysis of thymol in aqueous solution was developed in order to study the toxic effects of varying concentrations of thymol on the snail, *Australorbis galbratus,* the vector of schistosomiasis. Recent studies in our laboratory have shown that thymol is considerably more toxic than menthol, but not as toxic as copper(ic) ion. The method is based on the fact that thymol in aqueous solution shows a strong ultraviolet absorption with a well-defined maximum at 274 mu. Studies of the reproducibility of the method show a range of 0.2 to 1.2 per cent with an average deviation of replicate determinations of 0.68 per cent. The relation between concentration and absorbance is linear through a range of 0.001 to 0.15 mg./ml. thymol. The molar extinction coefficient is 2006.7. A colorimetric method for thymol analysis was also developed for determination of less than gamma quantities of thymol. This method follows the Lambert-Beer Law through a range of 0.0001 to 0.005 mg./ml. The method has an average deviation of 1.0 per cent. This method is based upon the development of a pink color by reaction of thymol with vanillin in concentrated sulfuric acid solution.

W. F. von Oettingen (1), in his thorough review of the relation between the chemical structure and the effect of phenols on the organism, lists some fifteen color reactions which thymol undergoes. These reactions were apparently never studied as quantitative procedures. Seidel (2) determined thymol quantitatively by a titration method using a bromate-bromide solution, with a reported error of 1 per cent of the theoretical value. Kendall (3) determined quantitative amounts of thymol by its formation of an addition compound with picric acid to produce an organic compound having a specific melting point. Brown and Kremes (4) utilized this same method for their determination, using the ester of 3, 5—dinitro benzoic ester instead of picric acid. Pucker and Burd (5) determined thymol by coupling it with diazotized sulfanilic acid in alkaline solution and measuring the resulting color colorimetrically. The latter determi-

*Supported in part by funds from research project #382 of the University of Alabama Research Committee.

nation was chosen for a comparison with the spectrophotometric method in this paper.

METHOD

Apparatus. All absorbance measurements for the spectrophotometric method were made with a Model DU Beckman spectrophotometer. Potentiometric balance was obtained by varying the setting of the sensitivity control. The wave length scale of the instrument was calibrated against a hydrogen discharge lamp. A constant slit width of 0.5 mm. was chosen as to give a maximum sensitivity while decreasing the possibility of stray light interference. The photometric accuracy of the instrument was checked by the method of Ewing and Parsons (6) and found to be within the limits described by these authors. All measurements were made in matched 1 cm. silica cells against a distilled water blank.

All colorimetric measurements were made using a Coleman Model 6-C spectrophotometer. The solutions containing thymol were read in 18 x 180 mm. pyrex test tubes that were matched within 1 per cent transmittance using a reagent blank for zero absorbance.

Reagents. The thymol used for the determinations in this paper was obtained from two sources—one from the Eastman Organic Chemical Company, with a melting point range of 46° to 50.5° C.; the other from Matheson, Colleman, and Bell Company, with a melting point range of 48° to 50.5° C.

The A. C. S. Reagent grade sulfuric acid used for the colorimetric determinations was obtained from J. B. Baker Chemical Co. and the vanillin from Eastman Organic Chemical Company. All solutions were made using de-ionized water.

PROCEDURE

Due to the low solubility of thymol in water and the difficulty encountered in quantitative transfer, all stock solutions were made in 100 ml. volumetric flasks using the weight difference technique. The application of heat to facilitate solution cannot be used as thymol is extremely volatile. The absorbance of the sample was determined at 274 mu. against a distilled water blank; the thymol concentration was then calculated as described under the heading Spectrophotometry.

In the colorimetric determination for thymol all unknowns are diluted to a total volume of 5 ml. in matched pyrex tubes. Five ml. of distilled water is used for a reagent blank. Two ml. of concentrated sulfuric acid is then added to each from a buret while cooling the reaction mixtures in an ice bath. The solutions are then thoroughly mixed by swirling each tube. The temperature of this mixture

must be kept low because of the volatility of the aqueous thymol at elevated temperatures. While the mixture is still submerged in the ice bath, 2 ml. of a 1 gram per 100 ml. solution of vanillin and concentrated sulfuric acid is added from a buret. The solutions are again thoroughly mixed and allowed to react in a constant temperature water bath for 20 minutes at 65° C. ± 1° C., using glass marbles as stoppers to prevent volatilization. After cooling, the optical density is determined against the reagent blank with a Coleman Junior Spectrophotometer using a wavelength of 525 mu. The color is stable for 30 to 50 minutes. The total concentration of thymol can then be determined by reference to the concentration transmittance curve. Our determinations show a linear relationship from .0001 to .005 mg./ml. However, further studies show that semi-quantitative data can be obtained by extending the concentration transmittance curve past its point of maximum linearity. Table 1 represents the reproducibility of repeated analyses using thymol solutions with a concentration of .01705 mg. per 5 ml.

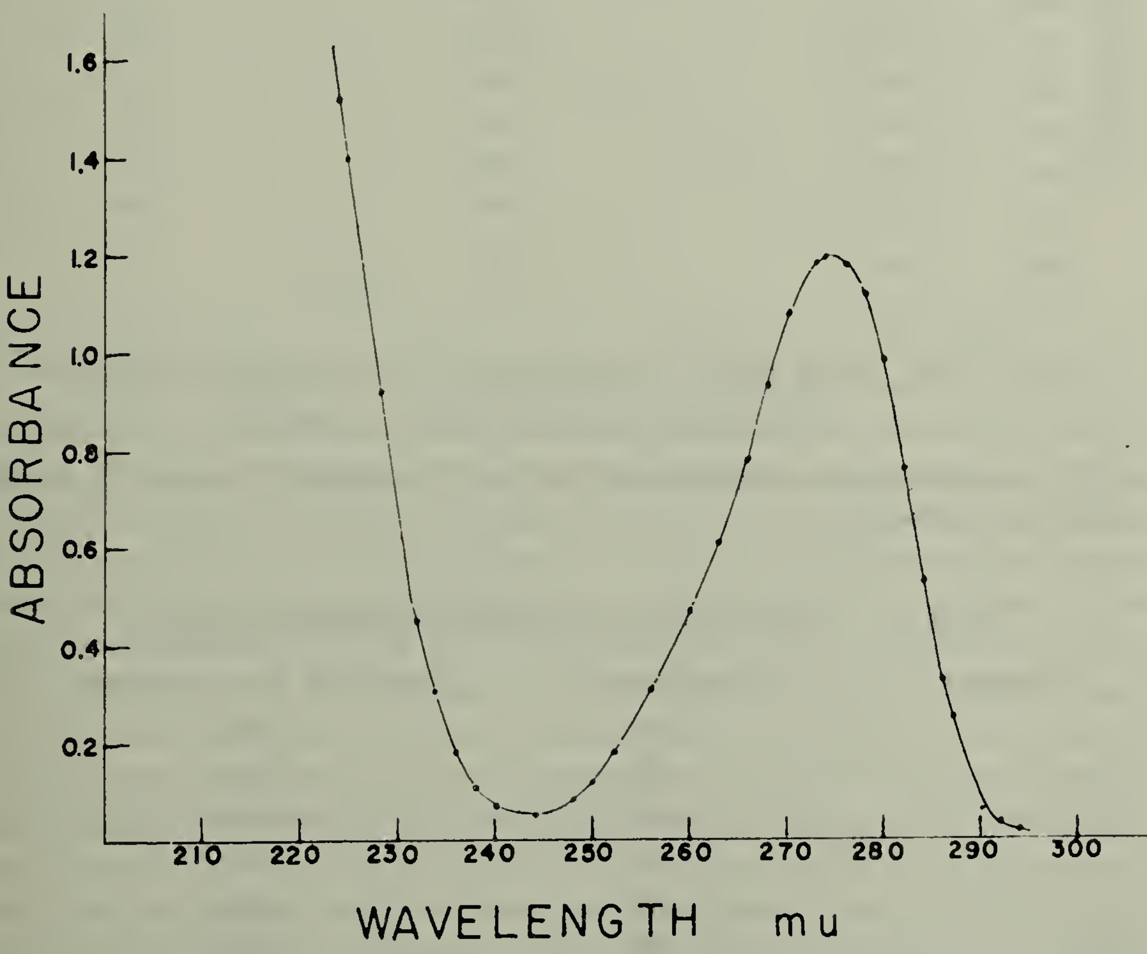


Fig. 1. The absorption spectrum of thymol in water.

Spectrophotometry. As seen in Fig. 1, thymol gives a single maximum at 274 mm., dropping smoothly off with no secondary maxima or minima. The molar extinction coefficient for thymol at 274 mu. was determined to be 2006.7. A series of dilutions from several different stock solutions of thymol established a linear relationship between absorbance and concentration at 274 mu. within the limits of .001 to .153 mg./ml. Fig. 2 represents the concentration absorbance curve for thymol.

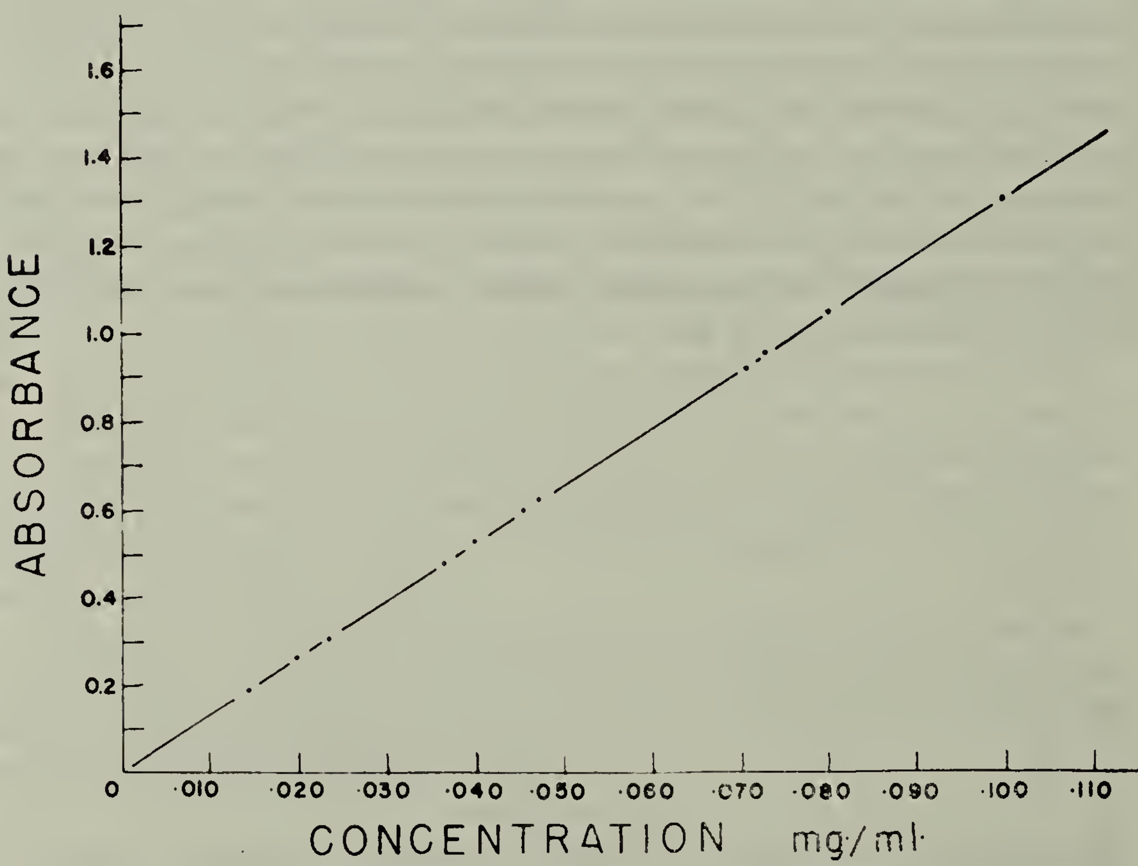


Fig. 2. The absorbance-concentration curve of dilutions of thymol in water measured at 274 mu.

Table 1. Reproducibility of repeated colorimetric analyses

Sample	Absorbance	Deviation from average
1	.547	—.002
2	.555	+.008
3	.535	—.012
4	.545	—.002
5	.545	—.002
6	.560	+.013
Average	.547	.006

Table 2. Reproducibility of repeated U. V. analyses with a concentration of .01175 mg./ml. of thymol.

Sample	Absorbance	Deviation from average
1	.154	—.003
2	.160	+.003
3	.155	—.002
4	.157	.000
5	.157	.000
6	.160	+.003
Average	.157	.002

Table 3. Reproducibility of repeated U. V. analyses with a concentration of .0454 mg./ml. of thymol.

Sample	Absorbance	Deviation from average
1	.600	—.002
2	.604	+.002
3	.600	—.002
4	.600	—.002
5	.604	+.002
6	.602	.000
Average	.602	.001

Since comparatively few quantitative tests for thymol have been published in recent years, it was necessary to choose an older method for a direct comparison with the new method. As previously mentioned, Pucker and Burd's coupling reaction with diazotized sulfanilic acid was chosen for this purpose. In order to use this method, spectral and concentration transmittance curves were determined. The authors reported that up to .5 mg. total of thymol could be quantitatively determined; however, it was our finding that linearity was established from only .001 to .06 mg. total. This being the case, it was necessary to make a direct comparison between the new method and the old one, using a concentration that would approach the maximum limits of linearity of the latter. It was also found that the results of the diazo reaction were not accurately reproducible from one determination to another. Table 2 indicates the reproducibility of the new test, using six samples all containing .01175 mg./ml. of

thymol. Analyzing the same samples, the old method had an average deviation of 6.7 per cent from the proposed method.

DISCUSSION

Under the existing circumstances for which the preceding microdeterminations were developed, namely thymol in aqueous solution, there is very little source of error except in the manipulation of the reagents and the use of volumetric apparatus. It is recognized that in future studies involving tissue homogenates or excretion products of *Australorbis galbratus* both tests may lack the required specificity for a quantitative determination.

With regard to the colorimetric determination for thymol using the color reagent vanillin dissolved in concentrated sulfuric acid, it has been observed that different sources of vanillin will often give slightly different values for the concentration transmittance curves. If the vanillin crystals are not pure white to colorless, the substance must be recrystalized several times using N-propyl alcohol as a solvent, washing each time with a quantity of cold water. Decolorizing carbon may be used to absorb some of the impurity. After dissolving the vanillin in concentrated sulfuric acid, it is necessary to refrigerate the solution which, under these conditions, should remain stable for two to three weeks.

REFERENCES

1. von Oettingen, W. F.: National Institutes of Health Bulletin No. 190, 1949.
2. Seidel, A.: J. Am. Chem. Soc. 47:508, 1912.
3. Kendall, S.: J. Am. Chem. Soc. 38:232, 1909.
4. Brown, J., and Kremes, S.: J. Am. Pharm. Assoc. 11:607, 1923.
5. Pucker, P., and Burd, H.: Proc. Soc. Exptl. Biol. Med. 21:565, 1924.
6. Ewing, G., and Parsons, T.: Anal. Chem. 20:423-5, 1948.

Important River Developments in Alabama

Richard A. Peacock

Warrior-Tombigbee Development Association, Birmingham

Few areas on earth have been so bountifully blessed with water resources as the state of Alabama. The streams and channels that etch its landscape are the keystone of an immense reservoir of wealth — much of which still lies untapped. Orderly, systematic development of these water courses to the maximum extent consistent with economic feasibility presents a golden challenge which, if accepted by the people of Alabama, will produce for themselves, their children, and their children's children tremendous dividends in terms of adequate water supplies, efficient navigation, additional electric power generation, abatement of stream pollution, alleviation of flood damages, more extensive recreational opportunities, and enhancement of fish and wildlife values.

Among the state's principal streams are the Black Warrior, Warrior and Tombigbee system, linking the excellent harbor at Mobile with the mines and industries of the interior; the broad and beautiful Tennessee, sweeping for 200 miles through north Alabama; the Chattahoochee, forming approximately half the boundary with Georgia; and the Alabama-Coosa, reaching for 650 miles from the Blue Ridge Mountains of northwest Georgia to the Mobile River in southwest Alabama.

There are, of course, numerous other rivers throughout the state, among them the Cahaba, the Tallapoosa, and the Choctawhatchee. The extent of Alabama's vast network of waterways is indicated by the mileage which Congress has authorized for development by the Corps of Engineers, U. S. Army. According to the best available compilations, the state leads the nation with 1,224 miles of authorized channels with depths of nine feet or more — as compared with 1,131 miles in Illinois, 834 in Kentucky, 822 in Missouri, 648 in Tennessee, and 534 in Iowa. Of the 1,224 miles of authorized projects in the state, only slightly more than half actually have been constructed, and therein rests the challenge we face.

In addition to its extensive system of inland rivers, Alabama also has along its coastline about 60 miles of the important Gulf Intracoastal Waterway — a light draft protected water route extending from Carrabelle, Florida, to the Mexican border at Brownsville, Texas — as well as the 36-foot Mobile Ship Channel that

makes Mobile one of the leading seaports of the United States.

The longest completed nine-foot barge channel in Alabama is the Warrior-Tombigbee Waterway. It reaches for approximately 465 miles from its mouth in Mobile Bay to points along its main headwater tributaries — the Mulberry, Locust, and Sipsey Forks — northwest of Birmingham.

The Warrior-Tombigbee Waterway was first canalized for navigation by 17 locks and dams, constructed between 1888 and 1915 to create a six-foot channel for small packet vessels then in use. These small, low-lift structures, totally inadequate to meet the demands of present-day towing equipment, are being replaced by modern, high-lift locks and dams designed to make the Waterway an efficient, dependable, low-cost means of transportation. When the improvement program is completed, there will be only six navigation projects, as contrasted with 17 originally.

In 1955, the new Demopolis Lock and Dam was completed a short distance below the confluence of the Warrior and Tombigbee Rivers as a replacement for four of the old structures. Its lock chamber — like the other new ones subsequently built or planned — is 600 feet long and 110 feet wide, more than twice the size of one of the old locks and sufficiently large to pass the biggest tow employed on the Waterway in a 30-minute operation, as opposed to two and a half hours at each of the original structures.

The modern Warrior Lock and Dam between Greensboro and Eutaw, about 50 miles upstream from Demopolis, was dedicated in 1958, eliminating two of the original navigation projects; and the Jackson Lock and Dam, located about 100 miles south of Demopolis, is to be completed by mid-1961 to replace three more.

The next new structure to be built is the Holt Lock and Dam, now in the pre-construction planning stage. It will be located approximately nine miles north of Tuscaloosa and will replace existing, obsolete Locks and Dams 13, 14, 15, and 16. These four small structures have been in operation since shortly after the turn of the century and constitute one of the Warrior-Tombigbee's last major obstacles to the efficient movement of commerce.

The other two projects in the new Warrior-Tombigbee system will be on the William Bacon Oliver Lock and Dam, built at Tuscaloosa in 1940, and the John Hollis Bankhead Lock and Dam, completed in 1915 and formerly known as Lock and Dam No. 17.

At the Oliver Dam, the lock chamber is 460 feet by 95 feet, somewhat smaller than the newer locks, but the structure otherwise is considered adequate. The Bankhead Dam, although 45

years old, still is sound structurally and should serve usefully for many more years. However, it has two locks 285 feet long and 52 feet wide that must be replaced by a single 600-by-110-foot chamber if optimum benefits are to be derived from the Warrior-Tombigbee.

In the headwaters of the Warrior River, above the head of navigation, the Alabama Power Company is building the Lewis Smith Dam and power plant on the Sipsey Fork. It will create an important measure of stream flow regulation to aid navigation, abate pollution, alleviate floods, and contribute toward dependable domestic and industrial water supplies. Under the present schedule, plans are to close the 300-foot-high dam late this year with the reservoir going into operation in mid-1961.

The Warrior-Tombigbee is one of the busiest and fastest developing channels in the Southeast. Its traffic has more than doubled since 1950, reaching 5,666,203 tons in 1958 to set a record high for the sixth consecutive year.

Another busy channel is the Tennessee River. It is formed in eastern Tennessee, flows southwest into northern Alabama, across north Alabama in a generally westerly direction to the northeast boundary of Mississippi, then north across Tennessee and Kentucky to join the Ohio River at Paducah. The overall length of its navigable channel is 650 miles.

Federal work to develop the Tennessee began in the 1850's. In more recent years, it has been extensively improved by the Tennessee Valley Authority for flood control, navigation, power production, and allied purposes. There are four projects along the Alabama reaches of the river: Dam No. 1 at Florence, completed by the Corps of Engineers in 1926, and raised 1.7 feet by T. V. A. in 1948; Wilson Dam, built three miles above Florence by the Army Engineers in 1927; General Joe Wheeler Dam, 18 miles above Florence, completed in 1936 by T.V.A.; and Guntersville Dam which T.V.A. constructed in 1939, nine miles below Guntersville.

A new lock with a lift of 100 feet — the highest single lift chamber in the world — was opened late last year at Wilson Dam to remove a major bottleneck to the Tennessee's growing volume of traffic, which in 1958 totaled 12,040,826 tons.

Forming almost half the Alabama-Georgia boundary is the Chattahoochee River, a part of the Apalachicola-Chattahoochee-Flint system lying in Georgia, Florida, and Alabama. It presently is being developed by the Corps of Engineers under a comprehensive plan to provide a barge channel from the Gulf Intracoastal

Waterway to the twin cities of Phenix City, Alabama, and Columbus, Georgia, on the Chattahoochee; and to Bainbridge, Georgia, on the Flint, a total distance of about 315 miles. In addition, the plan is designed to produce flood protection in the upper Chattahoochee Valley and a substantial block of electric power.

The channel in the Apalachicola River was created by dredging, snagging, and rectification work, completed in 1957. Also completed during the same year was the majestic Jim Woodruff Dam, situated immediately downstream from the point where the Chattahoochee and Flint join to form the Apalachicola. Jim Woodruff Dam is a navigation and power project whose great two-pronged reservoir provides navigable depths upstream to Bainbridge, Georgia, on the Flint and to Columbia, Alabama, on the Chattahoochee.

Columbia Lock and Dam is being built at the head of the lake behind the Jim Woodruff Dam to extend the barge channel to Fort Gaines, Georgia. A navigation structure only, it is scheduled for completion in 1963.

At Fort Gaines, construction is under way on the two-and-a-half-mile-long Walter F. George Lock and Dam which will form an 85-mile-long lake reaching upstream to Columbus-Phenix City. It also is to be completed in 1963.

On the upper Chattahoochee is a fourth structure, a headwaters regulating dam near Buford, Georgia. Its purpose is to provide flood control along the upper Chattahoochee, with some flood height reduction as far downstream as West Point, 150 miles from the dam; to increase the flow in the Chattahoochee and Apalachicola during low water seasons; and to generate about 170 million kilowatt hours of electric energy annually. Buford Dam, with a lake covering 38,000 acres, was completed in 1957.

On the Alabama-Coosa River, little commerce has moved since the last of the romantic packets ceased operation in 1934. However, studies by the Corps of Engineers indicate that a considerable volume of traffic would move if a modern nine-foot channel were available.

Congress has authorized the eventual comprehensive improvement of this marvelous river system. Under the program, the Alabama River is to be developed by dredging from its mouth to Claiborne in Monroe County and by the construction of locks and dams at Claiborne, Millers Ferry in Wilcox County, and Jones Bluff in Lowndes and Autauga counties. The Millers Ferry and

Jones Bluff structures would include power plants. The channel thus provided would reach as far upstream as Montgomery.

The Alabama Power Company has three power projects on the Coosa River — Jordan, Mitchell, and Lay Dams, built, respectively, in 1929, 1923, and 1914. At present, the company is engaged in a 10-year program to raise the height of Lay Dam by 14 feet and to construct four new dams on the Coosa. In addition to providing new sources of power generation and an important measure of flood control, Alabama Power's projects also are designed for the future addition of navigation facilities.

On the basis of a 1958 study by the Corps of Engineers, the Board of Engineers for Rivers and Harbors recommended that, as soon as the Alabama River is developed to Montgmery, the channel be extended up the Coosa River to Gadsden by constructing locks in the existing and planned Alabama Power dams and that, when this has been accomplished, consideration be given to further extending the channel to Rome, Georgia.

No funds yet have been appropriated by Congress to build any of the proposed federal projects on the Alabama-Coosa, and nothing was recommended in the Budget for fiscal 1961.

Another authorized project affecting Alabama is the proposal to link the Tombigbee and Tennessee Rivers along a route through Mississippi to Pickwick Pool on the Tennessee. Such an undertaking would be gigantic in scope, comparable to the construction of the Panama Canal.

Congress authorized the connection in 1946, but no work has been done. Generally, the plan calls for the improvement of 168 miles of the Tombigbee River between Demopolis, Alabama, and Amory, Mississippi, by constructing four locks and dams; for a 45-mile-long canal with five locks and dams; and for a 40-mile-long divide cut containing one lock and dam.

Since the project, whose latest approved cost estimate was $227 million, showed a marginal economic justification based on studies of some years ago, it was deferred for restudy in accordance with criteria established in a 1953 directive from the Public Works Committee of the House of Representatives.

Money for the restudy was apropriated in 1956. The Mobile District of the Corps of Engineers is now making the restudy to ascertain the project's economic justification in the light of existing conditions. The report will be forwarded for review at higher Army Engineer echelons. Conclusions reached in the study will be made public after all reviews are completed.

Alabama Academy of Science
Membership List

April, 1961

INDUSTRIAL MEMBERS

Birmingham Slag Company, 2019 North 6th Avenue .... Birmingham
Waters Theatre Company, 2839 Cahaba Road .... Birmingham

SUSTAINING MEMBERS

Alabama College .... Montevallo
Auburn University .... Auburn
Birmingham-Southern College .... Birmingham
Florence State College .... Florence
Howard College .... Birmingham
Huntingdon College .... Montgomery
Livingston State College .... Livingston
Spring Hill College .... Spring Hill
University of Alabama .... University
Exchange Security Bank, Five Points South .... Birmingham
R. D. Russell
Southern Natural Gas Company, Box 2563 .... Birmingham
Dr. J. D. Bush, Box 877 .... Gadsden
First Federal Savings and Loan Association .... Birmingham
George R. Byrum, Jr., President
Dr. Hamilton Louis J. Marshall, 118 Florence Place .... Mobile

REGULAR MEMBERS

The following symbols are used to designate section preference:

Section	I	BS	Biological Sciences
	II	C	Chemistry
	III	GA	Geology and Anthropology
	IV	FGC	Forestry, Geography, and Conservation
	V	PM	Physics and Mathematics
	VI	IE	Industry and Economics
	VII	SE	Science Education
	VIII	SS	Social Sciences
	IX	MS	Medical Sciences

The following symbols indicate special classes of membership:

*	Complimentary, Junior Academy sponsor
**	Collegiate
†	Honorary
*†	Life

Name and Address	Section

A

Adams, Cleveland L., 845 Cary Drive, Auburn	IE
Agee, Rucker, 706 First National Bank Bldg., Birmingham	IE
Aiken, W. C., 16 Edgewood, Selma	FGC
Alexander, Dr. Thomas B., Box 3264, University	SS
Alford, William L., 4317 Horace Drive, N. W., Huntsville	PM
**Allen, Miss Attrice G., Box 142, Bellamy	BS-C
Allen, John Hollie, 244 Edgewood Drive, Florence	SS
Allen, Paul L., Box 103, Brewton	FGC
Allen, Ralph H., Jr., Ala. Dept. of Conservation, Montgomery	FGC
Allen, Roger W., Auburn University	C
†Allison, Fred J., Huntingdon College, Montgomery	PM
Almond, Joseph C., Riverside Hospital, Newport News, Va.	MS
*Alverson, S. H., Munford High School, Munford	SE
Alvord, Ben F., Auburn University	SS
**Anderson, Mrs. Katherine, 640 West Patton Street, Montgomery	BS
Andrews, Henry L., Box 797, University	SS
Anson, Dr. Charles P., Auburn University	IE
Arant, Frank S., Auburn University	BS
Arnold, Paul J., Jacksonville State College, Jacksonville	SE
Askew, Harold C., University Medical Center, Birmingham	MS
Atkins, A. J., Auburn University	SE
**Avery, Jack C., Route 3, Oneonta	BS

B

*Bailey, Autry L., Pell City High School, Pell City	SE
Bailey, Hugh C., Howard College, Birmingham	SS
Bailey, Paul C., Alabama College, Montevallo	BS
Ball, Richard W., Auburn University	PM
Bancroft, William H., Jr., 620 Hoadley Drive, Birmingham	PM
*Baranelli, Michael, Phillips High School, Birmingham	SE
Barker, Augustus L., 227 Marion Avenue, Auburn	C
Barker, Samuel B., University Medical Center, Birmingham	MS
Barr, E. Scott, Box 714, University	PM
Barrett, William J., Southern Research Institute, Birmingham	C
Basore, C. A., Auburn University	C
Baswell, John L., 5613 10th Avenue South, Birmingham	IE
Batson, John O., Box 37, Bellamy	FGC
Baughman, Dr. Willis J., Box 2552, University	SE
*Baxter, John L., Tallassee High School, Tallassee	SE
Bell, Miss Josephine R., 3612 Valencia Pl. N.E., Albuquerque, N.M.	BS
Bennett, J. Claude, 724 McMillan Avenue, Birmingham	MS
Benton, Noel P., State Dept. of Education, Montgomery	PM
**Berdanis, Miss Nina, 102 Vonora Avenue, Montgomery	BS
*Berryman, W. C., Sylacauga High School, Sylacauga	SE
Bertha, Sister M., O.S.B., Sacred Heart Academy, Cullman	PM
Biebel, Paul, 4152 Yorkshire Lane, Mobile	BS
Bingham, Clarence P., 51 Cloverdale Road, Tuscaloosa	GA

Bishop, Everett L., Jr., Box 1927, University ---------- BS
*Black, Clifford D., Albertville High School, Albertville ---------- PM-SE
Black, William B., Gulf States Paper Corporation, Tuscaloosa ---------- FGC
Blair, Arthur J., 1820 First National Building, Birmingham ---------- GA
Blair, Dr. John Clyde, State Dept. of Education, Montgomery ---------- BS
Blair, Dr. Mary Grace, 1103½ W. 4th Street, Little Rock, Ark. ---------- C
**Blalock, Miss Evelyn B., Route 3, Box 233, Quitman, Ga. ---------- BS
Bliss, Russell, Auburn University ---------- SS
Boehmer, Miss Kathryn M., 3928 Avenue K. Fairfield Station, Birmingham ---------- SE
Bonin, Joseph M., Auburn University ---------- SS
*Boozer, Charles, Childersburg High School, Childersburg ---------- SE
Boozer, Reuben B., Jacksonville State College, Jacksonville ---------- BS
Boschung, Herbert T., Jr., Box 1927, University ---------- BS
Boshell, Buris R., Veterans Administration Hospital, 700 South 19th Street, Birmingham ---------- MS
Boyles, James M., Box 1475, Mobile ---------- BS
*Bradford, Mrs. Ibbie King, S. R. Butler High School, Huntsville ---------- SE
Bradley, Miss Carolyn F., Auburn University ---------- BS
Bradley, Charles F., Jr., Weather Bureau, Airport Station, Birmingham ---------- FGC
Bradley, John M., Jr., Hwy. 280, Box 7527, Birmingham 13 ---------- FGC
Brame, J. Y., 1568 College Court, Montgomery ---------- GA
Brannon, Mary Jane, 2080 Myrtlewood Drive, Montgomery ---------- BS
Brannon, Peter A., Dept. of Archives and History, Montgomery ---------- GA
Braswell, Mamie, Country Club Apts., 1631 E. Fairview, Montgomery PM
*Bray, Gerald, O.S.B., St. Bernard ---------- C
Brezina, Dr. Edward S., Armed Forces Institute of Pathology, Washington 25, D. C. ---------- MS
Brown, Earl I., II, Duke University, Durham, N. C. ---------- PM
Browning, James S., Box L., University ---------- GA
Brunson, Fox H., 2751 Ralston Road, Mobile ---------- BS
*Bulger, V. L., Chilton County High School, Clanton ---------- SE
Bunger, William B., 603 Dumas Drive, Auburn ---------- C
Bunton, Paul B., 2900 Connecticut Avenue, Washington 8, D.C. ---------- GA
Burton, L. P., Auburn University ---------- PM
Bush, Dr. J. D., Box 877, Gadsden ---------- MS
Butler, D. E., Troy State College, Troy ---------- SE

C

Cairns, Eldon J., Auburn University ---------- BS
Campbell, Mrs. James J., 1400 Forest Lane, Anniston ---------- C
Cantnell, Jerald Wayne, 2030 Ninth Avenue South, Apt. N-1, Birmingham ---------- BS
Cantrell, Dr. Clyde H., Box 290, Auburn ---------- SS
Capps, Julius D., Box 309, Auburn ---------- C
†Carmichael, Emmett B., University Medical Center, Birmingham ---------- MS
Carmichael, John L., 3522 Salisbury Road, Birmingham ---------- MS
Carr, Howard E., Auburn University ---------- PM
Carroon, Lamar E., Box 56, Montgomery ---------- GA

Carter, Hugh P., 503 Title Guarantee Bldg., Birmingham .... SS
Casey, Albert E., 2236 Highland Avenue, Birmingham .... MS
Cason, Mrs. Louise R., University Medical Center, Birmingham ... MS
*Causey, Lawson V., Box 1152, Anniston ....
Chaney, David W., Chemstrand Research Center, Box 731,
Durham, N. C. C
Chapman, Warner E., 1004 Audrey Drive, Holly Hill,
Daytona Beach, Fla. .... BS
Chastain, E. D., Jr., Auburn University .... SS
Chermock, Ralph L., Box 1927, University .... BS
Chipman, Russell L., 3106 Pelzer Avenue, Montgomery .... FGC
Clark, Father Victor J., O.S.B., St. Bernard Abbey, Cullman .... SE
Clark, Otis M., Jr., 64 The Glen, Route 3, Tuscaloosa .... GA
Cole, Frank T., 562 Tuttle Avenue, Mobile .... FGC
Coleman, Mrs. Mary E., Auburn University Extension Service .... SS
Comer, Gordon, Jr., 233 Springhill Road, Alexander City .... FGC
**Conway, Ophelia Ann, Route 1, Maplesville .... SE
Cook, John M., Box 693, University .... GA
*Cook, Lloyd M., Opp High School, Opp .... SE
*Cooper, Miss Opal, Cullman High School, Cullman .... SE
*Cornett, Miss Nancy, Pell City High School, Pell City .... SE
*Cost, James C., Eufaula High School, Eufaula .... SE
Cotter, David J., Alabama College, Montevallo .... BS
*Countryman, Mrs. Ruby, A. G. Parrish High School, Selma .... SE
Covington, Perry C., 316 West Glenwood Drive, Birmingham .... IE
*Cowart, Mrs. Gladys W., Troy High School, Troy .... SE
Cowin, Percy G., 1 S.W. 18th Street, Birmingham .... GA
Crafts, Arthur G., Auburn University .... PM
Craig, Alfred B., 3506 Westover Road, Durham, N. C. C
Craig, Ed, Jr., 1240 50th Place South, Birmingham 12 .... GA
Cramer, Dale L., Box 1973, University .... SS-IE
Croker, Thomas C., Jr., Box 311, Brewton .... FGC
Culmer, Miss Orpha Ann, Florence State College, Florence .... PM
**Culpepper, Bradley, Woodley Road, Montgomery .... BS
Curl, Elroy A., Auburn University .... BS
*Cyr, S. C., Brother, McGill High School, Mobile .... SE

D

Dahlen, E. O., 1616 33rd Street West, Birmingham 8 .... GA
Dale, William P., II, Howard College, Birmingham .... SS
Daniel, Adrian George, 1914 Holiday Drive, Florence .... SS
Daniel, Thomas W., Geological Survey of Alabama,
Drawer O, University .... GA
Davey, Bessie L., Box 2634, University .... BS
Davis, Donald E., Auburn University .... BS
*Davis, J. O., Gadsden High School, Gadsden .... SE
Davis, James Miller, 212 Guaranty Savings Bldg., Montgomery .... GA
Davis, Norman D., 1616 Wright's Mill Road, Auburn .... BS-SE
Dean, Mrs. Blanche, 1228 South 29th Street, Birmingham .... BS
DeJarnette, David L., Box 66, Mound State Monument, Moundville .... GA

Deuel, Dr. James T., 3818 Narrow Lane Road, Montgomery 8 .... BS
**Detrio, John A., Box 4725, University .... PM
DeVall, Wilbur B., 736 Cary Drive, Auburn .... FGC
Dickinson, Harry E., 1761 South Lakeshore Drive, Birmingham 9 .... SS
Diener, Urban L., Auburn University .... BS
Dietz, Dr. Robert A., Troy State College, Troy .... BS
**DiMassio, Charles, University of Alabama .... GA
Dixon, Joe B., Auburn University .... GA
Dodson, Chester Lee, Box 588, Hartselle .... GA
*Dorris, E. G., Coffee High School, Florence .... SE
Doster, Mrs. Charles S., 2924 Hastings Road, Birmingham .... BS
Doster, James F., Box 1955, University .... SS
Doubles, Dr. James A., Jr., Birmingham-Southern College, Birmingham .... BS
Douglas, Miss Sarah F., 212 Mecca Ave., Birmingham .... BS
Dowdy, Felix, International Paper Company, Mobile .... FGC
Duffey, Lowell M., University Medical Center, Birmingham .... BS-MS
**Duncan, Archie B., 213 49th Street, Fairfield .... BS
Dunning, Abram B., Box 499, Room G-309, Fairfield .... PM
Dusi, Julian L., Box 742, Auburn .... BS
Dusi, Mrs. J. L., Box 742, Auburn .... BS
Dykes, Donald J., 1904 16th Avenue South, Birmingham .... BS-C

E

**Eich, Foster, III, Box 47, Fort Davis .... MS
Eisele, Louis J., S. J., Spring Hill College, Mobile .... PM
Elder, R. H., 1613 32nd Avenue North, Birmingham C
Elkayar, Dr. Abd Elmaquid, Auburn University .... PM
Elliott, Howard C., Jr., 629 Hambaugh, Birmingham .... MS
**Ellis, John Thomas, Foundation des Etats-Unis, 19 Pd. Jourdon, Paris, France .... PM
*Ellison, Mrs. Dorothy S., Dora High School, Dora .... SE
Elton, Carey F., 728 Berea Avenue, Gadsden .... PM
Emerson, Dr. Geraldine M. (B.), University Medical Center, Birmingham .... MS
Emerson, Jack D., University Medical Center, Birmingham .... MS
Englebrecht, Mildred A., Box H., University .... BS
Estes, Dr. Edna E., State Teachers College, Salisbury, Md. .... BS
Evans, Dr. Lawrence E., Ontario Veterinary College, Guelph, Canada .... MS
Everton, Edgar R., Walker College, Jasper .... GA
Evers, Ray, Andalusia .... MS

F

Farish, Preston, 937 Lakeview Drive, Auburn .... BS
†Farmer, C. M., Troy State College, Troy .... BS
**Farmer, Joe A., Box 2782, University .... BS
Farnell, Dr. Daniel R., 1157 Rudd Avenue, Auburn .... MS

*Faulkner, Mr., Sidney Lanier High School, Montgomery .... SE
Feazel, C. E., Jr., Southern Research Institute, Birmingham C
Fies, Dr. Milton H., 1201 Comer Building, Birmingham .... IE
Fincher, J. A., Howard College, Birmingham .... BS
Finley, Dr. Wayne H., University Medical Center, Birmingham C
Finn, Sidney B., University Medical Center, Birmingham .... MS
Fitzgerald, Richard W., 1805 Holly Street, Montgomery .... BS
Fleming, Julius D., 328 Palisade Drive, Florence C
Floyd, H. H., Florence State College, Florence C
Foley, Mrs. James O., 409 Sunset Drive, Birmingham .... MS
**Forester, Jerrold, Route 2, Box 76, Jasper .... GA
Foster, Frank J., Box 2242, University .... FGC
Fox, Glenn J., 573 Clearview Drive, Birmingham 16 .... BS
Francis, Robert D., University Medical Center, Birmingham .... MS-BS
Friedman, Dr. Louis L., 2528 Beverly Drive, Birmingham .... MS
Frisby, Carl E., Auburn University .... IE
*Fulcher, W. W., Murphy High School, Mobile .... SE
Furman, Father W. L., Spring Hill College, Mobile .... PM

G

Gallaway, Robert E., 6030 South 5th Court, Birmingham .... MS
Gamble, Halbert R., 3805 Day Street, Lot E-22, Montgomery 8 .... GA
Gandrud, B. W., 311 Caplewood Terrace, Tuscaloosa .... IE
Garin, George I., Auburn University .... FGC
Garner, Robert H., Box H., University C
Garren, Robert E., 118 South Ross Street, Auburn .... SS
**Garrett, Arthur Randolph, Jr., 5 Bloch Street, Montevallo .... BS
Garrett, Mrs. Marion H., 4212 Overlook Drive, Birmingham .... MS
Garrett, W. Walton, 4212 Overlook Drive, Birmingham .... IE
*Gary, Mr. C., Emma Sansom High School, Gadsden .... SE
Gary, C. M., 800 North Pelham Road, Jacksonville C
Gayle, John B., M-S&M-MG, National Aeronautics and Space Administration, George C. Marshall Space Flight Center, Huntsville C
*Geisler, Miss Edith, Hueytown High School, Bessemer .... SE
Gerhardt, Henry, 150 Hannon Avenue, Mobile .... MS
**Gibbs, Billy, 102 N.W. 10th Street, Arab .... PM
*Gilmore, Mrs. Vivian, Choctaw County High School, Butler .... SE
Glarum, Dr. Sivert N., Southern Research Institute, Birmingham C
Glasgow, Dr. Richard D., 3009 Brookwood Road, Birmingham 13 .... MS
*Gober, Mrs. Gordon, Red Bay High School, Red Bay .... SE-C-BS
*†Goethe, Dr. Charles M., 3731 Tea Street, Sacramento 16, Calif. .... BS
Goetz, James R., 2021 6th Avenue North, Birmingham .... IE
Gordon, Dr. Kenneth M., Birmingham-Southern College, Birmingham C
Gore, Clayton E., Jr., 1828 Oxmoor Road, Birmingham .... GA
Gorrie, Miss Rachel H., 3155 Montezuma Road, Montgomery .... BS
Gran, Dr. John E., 6 Hillcrest, Tuscaloosa C
**Gray, Sidney F., 314 Elyton Parkway, Birmingham .... GA
**Gray, T. Randolph, 4700 Avenue T., Central Park, Birmingham .... GA
Green, Margaret, Box H., University .... MS
*Grench, Mrs. John, A. G. Parrish High School, Selma .... SE

Grove, Dr. E. L., Armour Research Foundation, 10 West 35th Street Chicago 16, Ill C
Guest, William C., Box 1927, University .... BS
*Guthery, M. D., Auburn High School, Auburn .... SE

H

*Hafling, Miss Mary E., West End High School, Birmingham .... SE
Hall, Clarence C., Jr., Howard College, Birmingham .... BS
Hamlett, Miss Mary Kline, 25 Edgehill Road, Birmingham .... MS
Hammack, J. J., Livingston State College, Livingston C
Hampe, David E., 2720 Mt. Royal Circle, Birmingham .... FGC
Hansen, A. T., Box 2982, University .... GA-SS
Hanson, Roger W., University Medical Center, Birmingham .... MS
Hare, Ruth S., 8944 Fourth Avenue South, Birmingham .... MS
Hargis, Dr. Estes H., 1131 North 28th Street, Birmingham .... MS
Hargreaves, George W., 235 Woodfield Drive, Auburn C
*Hargrove, Mrs. Geraldine, Tuscaloosa County High School, Northport SE
†Harper, Roland M., Box O, University .... GA
*Harris, Miss Ethel, Montevallo High School, Montevallo .... SE
Harris, Wiley F., Jr., 222 4th Avenue N.W., Decatur .... GA
Harrison, David George, 1924 9th Avenue South, Birmingham .... BS
Harrison, Sister M. Eleanor, Sacred Heart Academy, Cullman .... PM
Hartley, Dr. Marshall W., 2221 Mountain Lake Terrace, Birmingham MS
Hartwig, Chester W., 633 Sanders Street, Auburn .... SS
Harvey, Dr. Henry T., 2317 Houston St., Florence .... BS
Haskell, Preston H., Jr., 205 South 32nd St., Birmingham .... GA-FGC-IE
Hastings, Earl L., Geological Survey of Alabama, University .... GA
Hawley, William L., 312 Medical Arts Building, Birmingham .... MS
Hayles, Miss Kitty Sue, 340-A Perry Street, Chickasaw .... SE
Heide, S. S., 2204 28th Street West, Birmingham C
Hemphill, A. F., Spring Hill College, Mobile .... BS
*†Hendon, John F., 1631 3rd Avenue North, Birmingham .... IE
Herndon, Walter R., Box 1927, University .... BS
Herren, Glen W., 2105 Warrior Road, Box 3873, Birmingham 8 .... SS-MS
Heustess, William Arthur, 1313 Adrian Lane, Montgomery .... BS
Heyn, Dr. Anton N. J., Auburn University .... PM-BS-C
Hicks, Patrick M., LaGrange College, LaGrange, Ga. C
Hicks, Thomas I., Route 4, Box 720, Birmingham .... PM
Hieserman, Clarence E., Chemstrand Corporation, Decatur C
Hill, Johnie B., Jr., 7810 7th Avenue South, Birmingham .... BS
Hill, Dr. S. Richardson, Jr., University Medical Center, Birmingham .... MS
Hirschowitz, Basil I., University Medical Center, Birmingham .... MS
Hisey, Alan, Box 1412, University .... MS
Hitchcock, J. G., Alabama Power Company, Birmingham .... IE
Hites, Robert W., Birmingham-Southern College, Birmingham .... SS
Hitt, Miss Nellie W., Box 255, Troy .... SE
Hocking, George M., Auburn University .... MS
*Hodge, Mrs. Ruby, McAdory High School, McCalla .... SE
Hodgkins, Dr. Earl J., 555 Wright's Mill Road, Auburn .... FGC
Hoffman, Henry H., University Medical Center, Birmingham .... MS

Hogelin, Milford C., 3010 Circle Drive, Bessemer .... FGC
Holley, Howard L., University Medical Center, Birmingham .... MS
**Holliman, Dan C., Box 1927, University .... BS
Hooks, W. Gary, Box 1945, University .... GA
**Hopper, Bruce E., 536 North Ross, Auburn .... BS
**Howell, G. L., High Point College, High Point, N. C. .... BS
Howes, Dr. James Raymond, Box 574, Auburn .... BS-MS
Howse, B. C., Box 537, TCI Division, Fairfield .... BS
Huff, C. F., Jr., Florence State College, Florence C
*Huffman, Mrs. Elizabeth, Shades Valley High School, Birmingham .... SE
Huffman, Ernest O., 909 North Pine Street, Florence C
**Hunt, Miss Joan H., Route 2, Box 424-A, Montgomery .... BS
Hunt, Thomas E., University Medical Center, Birmingham .... MS
Hurtt, Oscar Lee, Jr., Drawer 2562, Birmingham C

I

Irons, George V., 8143 Division Avenue, Birmingham .... SS
Irvine, Paul, Auburn University .... SS
Ivey, William D., Auburn University .... BS

J

†Jennings, Henry L., Box 263, Clearmont, Fla. .... IE
**Johnson, Eugene F., Route 2, Jacksonville .... BS
Johnson, Robert B., 1511 South 13th Street, Birmingham C
Johnson, Searcy H., Jr., 432 Longview Drive, Birmingham .... IE
Johnson, Walter H., 1919 7th Avenue South, Birmingham .... MS
Johnston, Dr. Elbert F., Athens College, Athens .... BS-MS
Jones, Douglas E., Box 1945, University .... GA
†Jones, Dr. E. V., 213 Vanderbilt Drive, Oak Ridge, Tenn. C
Jones, Mrs. Frances, 926 South Lawrence Street, Montgomery .... SE
Jones, Mrs. Jack, Livingston State College, Livingston .... BS
**Jones, James Raphael, 1804 Delta Street, Mobile .... PM
*Jones, Mrs. Rebecca, Fairhope High School, Fairhope .... SE
Jones, Walter B., University .... GA

K

†Kassner, J. L., 1620 2nd Avenue, Tuscaloosa C
Kaylor, Hoyt M., Birmingham-Southern College, Birmingham .... PM
Kearley, Francis J., Jr., Spring Hill College, Spring Hill C
Keeler, James E., 3576 North Georgetown Drive, Montgomery .... BS
Kelley, Roscoe D., Troy State College, Troy .... SE
Kemp, Dr. Robert T., 816 Linwood Court, South, Birmingham 5 .... C-SE
Kennamer, Earl F., Route 2, Box 384, Auburn .... FGC
*Killion, Frank, C. F. Vigor High School, Prichard .... SE
*Kincaid, James H., Thorsby High School, Thorsby .... BS
Kinson, Gordon Alastair, University Medical Center, Birmingham MS-C
Klapper, Clarence E., University Medical Center, Birmingham .... MS
Klapper, Mrs. Margaret S., University Medical Center, Birmingham MS
Klip, Dr. W., University Medical Center, Birmingham .... MS-PM

Klontz, Dr. Harold E., Auburn University ---- SS
Knight, Vernon J., Coosa River Newsprint Co., Coosa Pines ---- FGC
Kochakian, Dr. Charles D., University Medical Center, Birmingham MS
Krizek, Lt. Donald T., Research Studies Institute,
Maxwell AFB ---- BS-FGC-SE
Kuderna, Jerome G., 157 Cary Drive, Auburn ---- SE

L

Laffre, Dr. Randall O., Jr., 200 South Montgomery Street, Mobile 19 MS
*Lambert, Dr. Ray H., School of Organic Education, Fairhope ---- SE
LaMoreaux, Phillip E., Box 2033, University ---- GA
Land, Dr. James E., Auburn University ---- C
Langley, Leroy L., University Medical Center, Birmingham ---- MS
Lanham, Ben T., Auburn University ---- SS
Larguier, Everett, S. J., Spring Hill College, Spring Hill ---- PM
Larsen, Aubrey B., Box 952, Auburn ---- BS
Laseter, William Ray, 713 77th Way South, Birmingham 6 ---- C
Laster, William R., Jr., 2923 Central Avenue, Birmingham 9 ---- MS
Lawrence, Dr. Norman L., University Medical Center, Birmingham ---- MS
Lawson, J. Keith, Jr., 1310 Morningside Court, Decatur ---- C
Leibold, Armin A., Route 1, Box 448, Auburn ---- BS
Lenfesty, Franklin A., 148 Garfield Avenue, Florence ---- C
*Leo, Sister Mary, John Carroll High School, Birmingham ---- SE
*Leonard, Miss Lillian, Baldwin County High School, Bay Minette ---- SE
Lewis, Arthur J., Crescent Hill, Selma ---- SE
Lewis, Dr. F. A., Box 1444, University ---- PM
Lindall, Dr. Dale R., Box 8323, Gunter AFB, Montgomery ---- MS
*Lindsay, L. W., Tuscaloosa High School, Tuscaloosa ---- SE
Lindsay, Raymond H., University Medical Center, Birmingham ---- MS
**Lindsey, Miss Georgia I., Route 1, Elmore ---- BS
Lindsey, Ralph H., 325 West Mountain, Jacksonville ---- PM
Lipe, George W., College Apts., Route 1, Montevallo ---- BS
Livermore, Dr. David I., Box 1315, Gunter AFB, Montgomery ---- MS
Livingston, Knox W., Auburn University ---- FGC
Lloyd, Mrs. Lucile N., 16 North Bayview Avenue, Fairhope ---- C-SE
*Lois, Sister Mary, Bishop Toolen High School, Mobile ---- SE
Long, A. R., 1106 East Audubon Road, Montgomery ---- C
*Long, Mrs. Pauline K., Woodlawn High School, Birmingham ---- BS
Longley, Robert W., University Medical Center, Birmingham ---- MS
*Love, Richard, Pell City High School, Pell City ---- SE
Lueth, Francis X., Box 415, Centerville ---- BS
Lyle, Everett Samuel, Jr., Auburn University ---- FGC
Lyle, James A., Auburn University ---- BS

M

MacElvain, Robert C., Box O, University ---- GA
McCaffrey, J. E., International Paper Co., Mobile ---- FGC
McCann, Franklin T., Box 325, Auburn ---- FGC-GA
*McCartney, Mrs. Ester, Samson High School, Samson ---- SE

*McCluskey, Margaret, Route 15, Box 205, Birmingham 8 .... SE
McCullough, Herbert A., Howard College, Birmingham .... BS
McCullough, John M., 2844 Spann Place, Montgomery .... FGC
*McCurdy, Mrs. Caswell, Hayneville High School, Hayneville .... SE
McGlamery, Miss Winnie, Box O, University .... GA
**McKenna, Michael P., 1124 Montclair Road, Birmingham .... GA
McKnight, Everett A., Woodward Iron Co., Woodward .... FGC
McReynolds, Joseph L., Jr., 1461 Hamilton Road, Mobile .... GA
*McSpadden, Clyde J., Foley High School, Foley .... SE
McTyeire, Miss Evelyn (Clustie), 1804 Arlington Avenue, Bessemer SE
McVay, Thomas N., 19 Oakwood Court, Tuscaloosa C
Mainland, Gordon B., Jacksonville State College, Jacksonville ....
Mainland, Mrs. Rosemary C., 1116 9th Ave. North, Jacksonville .... BS
Manley, Mrs. Lillian C., 1211 Lake Lane, Demopolis .... C-BS-SE
Marshall, Hamilton, 118 Florence Place, Mobile .... MS
Martin, John Vincent, Box 456, Butler .... FGC
Martindale, William E., 424 Orchard Road, Birmingham 15 C
Mayer, William C., Jr., 1467 Alford Avenue, Birmingham C
Maynor, Dr. Hal W., Jr., 518 Cary Drive, Auburn .... PM
Melius, Dr. Paul, Auburn University C
Merkal, Richard S., Route 2, Box 20, Auburn C
*Merritt, Mrs. Mary, Geneva County High School, Hartford .... SE
Meyer, Freida L., 1410 Cloverdale Apts., Tuscaloosa .... BS
Miles, R. Vance, Jr., 1014 Myrtlewood Drive, Tuscaloosa .... FGC
Miles, Richard V., III, Suite 1006, First National Bank Bldg., Tuscaloosa .... FGC
Minton, Norman A., Auburn University .... BS
Mitchell, Dr. F. H., Box 860, Huntsville .... PM
Mixon, Aubrey C., 718 Cary Drive, Auburn .... BS
Mobley, Willard M., Box 6527, Tarrant .... IE
Moore, Brother, S. C., McGill Institute, Mobile .... SE
Moore, O. C., Auburn University C
Morehead, Beachley A., Chemstrand Corporation, Decatur C
Morgan, Roy B., 101 Brookside Drive, Greenville .... FGC
Morris, Ella D., Box 811, Mobile .... BS
Morris, Frederick K., 3334 Southmont Drive, Montgomery .... GA
Morris, Jack, 1101 North Jackson Avenue, Russellville .... GA
Mosley, Samuel A., Chemstrand Limited, Caleraine, North Ireland, United Kingdom C
Murdaugh, Dr. Herschel Victor, Jr., 16 Glenview Circle, Birmingham MS
Murray, Royce L., Alabama Power Co., Box 5266, Birmingham .... PM

N

Nakane, Paul K., Brown University, Providence, R. I. .... BS
Nancarrow, Virginia, 617 St. Charles Avenue, S.W., Birmingham .... BS
Nesbitt, Paul H., ADTIC, Research Studies Institute, Maxwell AFB GA
Newton, John G., 2200 Forest Lake Drive, Tuscaloosa .... GA
Nichols, Samuel H., Jr., 130 Cary Drive, Auburn C

**Nicholson, Catherine E., California Institute of Technology, Pasadena, Calif. BS
*Nixon, L. C., Tallassee High School, Tallassee SE
*Noles, B. V., Fort Payne High School, Fort Payne SE
Nunn, Grady H., Drawer I, University SS

O

O'Kelley, Joseph C., Box 1927, University BS
Ottis, Kenneth, Auburn University BS
Overton, Eleazer C., 2195 Warrior Road, 5 Points West, Birmingham MS

P

Padgett, Mrs. Carol Ann, Huntingdon College, Montgomery BS
Pallister, Hugh D., Box 1501, University GA
Palmer, George D., Jr., Box H., University C
Palmore, Robert D., 3029-B Cloverdale Road, Montgomery GA
Parfitt, Dr. Gilbert J., 2117 Pioneer Drive, Birmingham MS
Parker, W. V., Auburn University PM
Patton, Ernest Gibbes, Box 1927, University BS
Patton, Mrs. Francis M., University Medical Center, Birmingham C
Paul, Miss Edna, Bay Minette SE
Paustian, E. C., Route 4, Box 370, Decatur SS
*Pennington, Robert L., Ensley High School, Birmingham SE
**Pharris, Darrol I., Alabama College, Montevallo BS
*Phinney, Mrs. Ida Bell, Slocomb High School, Slocomb SE
Pigman, Ward, New York Medical College, Fifth Ave. at 106th St., N. Y. 29 MS
Pittman, Constance S., 1006 19th Street South, Birmingham MS
Pittman, Dr. James A., Jr., 1006 19th Street South, Birmingham BS-MS
Pitts, Robert G., 216 Genelda Avenue, Auburn PM
Poole, William L., 722 Woodward Building, Birmingham MS
Porter, Earl, 123 Florence Place, Mobile FGC
Powell, P. P., 126 West Glenn Avenue, Auburn C
**Powell, Miss Patricia Ann, Prattville BS
Powell, William J., 12 Brookhaven, Tuscaloosa GA
Prather, Mrs. Mary E., Auburn University BS
Price, Edwin O., 251 Cary Drive, Auburn C
Price, Emmett W., 1921 Lookout Street, Mitchell Park, Gadsden MS
*Price, J. L., Robert E. Lee High School, Montgomery SE
Price, Leroy, Smith Avenue, Elba PM

Q

Quigley, Dr. Mervin B., 2927 South 19th Street, Birmingham MS
Quintarelli, Dr. Giuliano, University Medical Center, Birmingham MS

R

Ramsey, Dr. John F., Box 1513, University SS
**Rau, William H., Route 4, Hanceville MS
Reece, Orvil Y., 1304 East 15th Street, Tuscaloosa GA
Reeder, Charles, 1905 Windsor Avenue, Montgomery PM

*Reid, Mrs. Harry, Parrish High School, Selma ---- SE
Reiner, Charles, O.S.B., St. Bernard College, St. Bernard ---- C
*Reynolds, William B., Woodlawn High School, Birmingham ---- SE-C
Rhein, Walter J., Spring Hill College, Spring Hill ---- PM
Richards, Dr. D. B., Auburn University ---- FGC
Richards, Dr. E. F., Box 1945, University ---- GA
Richardson, Dr. Jesse M., Box 567, Auburn ---- FGC
Richardson, Ronald John, Chemstrand Corporation, Decatur ---- C
Riggsby, Ernest D., Troy State College, Troy ---- SE
*Rives, John E., 826 Clark Street, Durham, N.C. ---- PM
*Robert, Sister Mary, RSM, Mercy High School, Mobile ---- SE
Roberts, Bruno R., Box 731, Durham, N. C. ---- C
Roberts, Leo Bogan, State Dept. of Agriculture, Montgomery ---- C
*Robinson, G. T., Russellville High School, Russellville ---- SE
Rodgers, Dr. Eric, Box 1472, University ---- PM
Roth, Wolfgang, 1625 9th Avenue South, Birmingham ---- C
*Ruf, Mrs. Hazel, Athens High School, Athens ---- SE
Rupert, Rodney H., Siluria Clinic, Siluria ---- MS
*Rush, Orville F., Jr., John Carroll High School, Birmingham ---- SE
*Rushing, Gerald, Curry High School, Jasper ---- SE

S

*Salmon, Mrs. Sarah A., Curry High School, Jasper ---- SE
Salmon, W. D., Auburn University ---- MS
Sanford, Thomas H., Jr., 2626 Bonita Circle, S.W., Huntsville ---- GA
Saunders, Charles R., 369 Payne Street, Auburn ---- C
Schneyer, Leon D., University Medical Center, Birmingham ---- MS
Schnitzlein, Dr. Harold N., University Medical Center, Birmingham MS
Schwartz, Dr. Ferdinand F., 916 South 20th Street, Birmingham ---- MS
Scott, Robert B., Jr., 14 Guilds Wood, Tuscaloosa ---- C
Searcy, Margaret Z., 50 Cherokee Road, Tuscaloosa ---- SS
Seibold, Herman R., Box 671, Greenport, Long Island, N.Y. ---- MS
Sensenig, E. Carl, University Medical Center, Birmingham ---- MS
Sevier, Sister Mary Susan, Sacred Heart Academy, Cullman ---- PM
Shackleford, John M., University Medical Center, Birmingham ---- MS
Shields, Alan J., Auburn University ---- SS
Shoffeitt, Paul E., 759 East Samford Avenue, Auburn ---- MS
Shotts, Reynolds Q., Forest Lake, Tuscaloosa ---- GA
Shumaker, Thomas P., 428 Prince Avenue, Tuscaloosa ---- C
*Simmons, Alvin, C. F. Vigor High School, Prichard ---- SE
Sizemore, W. R., Box 244, Tallassee ---- FGC
Skinner, Robert Wade, Route 4, Box 171-A, Montgomery ---- BS
Smalley, Glendon W., Sr., 4748 Ave. West, Ensley, Birmingham - FGC-C
*Smith, Miss Claudia, Minor High School, Birmingham ---- SE
Smith, Donald F., Box H, University ---- C-IE
Smith, E. V., Auburn University ---- BS
Smith, Frank J., Route 1, Box 187-A, Loxley ---- FGC
Smith, Mrs. H. Morgan (Marjorie), Box 545, Curundio, Canal Zone ---- SS
*Smith, Miss M. Phyllis, 1223 14th Street, Phenix City ---- BS
Smith, Robert Charles, 1235 Cresthill Road, Birmingham 13 ---- BS

Smith, Septima C., Box 1386, University ---- BS
Smith, William Everett, Box 506, Glencoe ---- GA
Snyder, Robert Loring, 3266 Wilmington Road, Montgomery ---- FGC
Spann, Ransom, 314 East Thach Avenue, Auburn ---- PM
Spencer, G. O., Troy State College, Troy ---- PM
Spencer, Miss Lilly H., Auburn University ---- SS
Spidle, Mrs. Marion W., 306 Cary Drive, Auburn ---- SS
Spieth, Alda May, Livingston State College, Livingston ---- BS
*Staub, Julius T., Wright School for Girls, 1315 Dauphin St., Mobile ---- SE
Stauffer, Jacob M., 32 Arlington Road, Montgomery ---- FGC
Steele, H. Ellsworth, Route 2, Box 451, Auburn ---- SS
Stelzenmuller, J. G., 412 S.W. 12th Street, Birmingham ---- IE
Stephens, Mrs. Lois Carter, Route One, Troy ---- BS
Stephens, Miles, Box 893, Auburn ---- FGC
Stephenson, Charles V., 1805 Mission Road, Birmingham ---- PM
Sterkx, Dr. H. E., Troy State College, Troy ---- SS
Sterne, Dr. M. H., RFD 2, Box 616, Birmingham ---- IE
Stevens, Frank J., Auburn University ---- C
Stewart, Miss Mary Elizabeth, Box 393, Marion ---- BS
Stickney, Mrs. Hazel L., Livingston State College, Livingston ---- FGC
Stone, Paul T., Huntingdon College, Montgomery ---- C
*Stoner, William C., Jr., Sylvania High School, Sylvania ---- SE
Strickland, Harold S., 756 Walnut Street, Gadsden ---- SE
Stuart, Fletcher S., 1624 13th Place South, Birmingham ---- MS
Sudhoff, Roy W., 1807 Stratford Road, S.E., Decatur ---- C
Sullivan, John L., Box 276, Birmingham ---- IE
*†Sulzby, James F., 1321 Carlisle Road, Birmingham ---- IE
Summerlin, Lee Roy, II, 2420 S.W. 27th Terrace, Miami, Fla. ---- BS
Summersell, Charles G., Box 1936, University ---- SS
Swindel, George W., Jr., 916 3rd Avenue, Lake Charles, La. ---- GA

T

Tankersley, Richard, Route 3, Alexander City ---- BS
Tanner, Ralph M., Route 1, Dora ---- SS
Tarbutton, Grady, 205 Wheeler Avenue, Sheffield ---- C
Tate, John M., Box 344, Arab ---- C
*Tatum, R. C., Murphy High School, Mobile ---- SE
**Taylor, Miss Jepye Lu, Box 481, Crestview, Fla. ---- BS
Taylor, M. Kenneth, Sharp's Apt., Bloch Street, Montevallo ---- BS
*Teague, John H., Decatur High School, Decatur ---- MS
Teague, Robert S., University Medical Center, Birmingham ---- MS
Thomas, Dr. Alfred B., Box 1491, University ---- SS
*Thomas, J. P., Tuscaloosa County High School, Northport ---- SE
Thompson, Davis Hunt, 917 Valley Road Place, Birmingham ---- C
Thompson, Mrs. Georgia J., Station 3, Bryce Hospital, Tuscaloosa ---- MS
Thompson, H. Leroy, 329 Brown-Marx Bldg., Birmingham ---- C-IE
Thompson, Mrs. Margene G., 353 Park Avenue, Shades Mt., Birmingham ---- SE
Thompson, Woodford R., Jr., 503 Title Bldg., Birmingham ---- C
Thompson, Mrs. Wynelle D., 917 Valley Road Place, Birmingham ---- C

Thomson, J. Richard, Southern Research Institute, Birmingham MS-BS
*Tillman, John V., Cullman High School, Cullman SE
Todhunter, Dr. E. Neige, Box 1051, University C
Toffel, George M., 303 Queen City Avenue, Tuscaloosa C
Tower, James Allen, Birmingham-Southern College, Birmingham FGC
Townes, M. Halsey, 2712 Mt. Royal Circle, Birmingham IE
*Traywick, R. L., Marion Military Institute, Marion SE
Trickey, Dr. E. Bruce, 215 Third Street, Chickasaw C-GA
Tucker, Edd Kyle, Box 97, Camp Hill C
Tucker, Olon C., Route 2, Grant BS
Turner, Henry F., Auburn University BS
Twellmeyer, George O., Spring Hill College, Mobile C

U

Ucci, Pompelio A., Chemstrand Corporation, Decatur C
Underwood, Mrs. Bertha A., 415 Lauderdale Street, Russellville SE

V

Van De Mark, Mrs. Mildred, Auburn University BS
Vardaman, Thomas H., 562 Dumas Drive, Auburn MS
Varnedoe,William, Jr., Route 4, Box 1811, Huntsville GA
Veazey, Dr. Thomas M., 2026 Woodland Street, Decatur C
Vess, David M., 1140 North Shadesview Terrace, Birmingham 9 SS
Viccars, Miss Marion, 2133 Mt. Meigs Road, Montgomery BS
Vickery, Katherine, Alabama College, Montevallo SS
Volker, Joseph F., University Medical Center, Birmingham MS
*Vuientte, Charles, Satsuma High School, Satsuma SE

W

Wade, Albert M., Jr., 2231 15th Avenue South, Birmingham BS-MS
Walker, Alfred A., III, 4137 Crescent Road, Birmingham MS
Walker, Dr. J. Henry, Box 1927, University BS
Walker, Katharene, Route 5, Mars Hill Road, Florence BS
Ward, Henry S., Jr., Pinecrest Farms, Route 2, Prattville BS
*Ward, Mrs. Mary E., Semmes High School, Semmes BS
Warman, James C., Box V, University GA
Watson, J. Hilton, Box 422, Montgomery FGC
*†Weber, Dr. Bernard C., Box 5315, University SS
Weidner, Dr. John P., 1600 Texas Drive, Pensacola, Fla. C
Weigel, Robert D., Illinois State Normal University, Normal, Ill. BS
*Wells, Miss Fay, Chilton County High School, Clanton SE
Westover, Frederick L., Box 1553, University SS
Whellahan, Edmund J., ABMA, Systems Design & Development Laboratory, ORDAB-RSMF, Redstone Arsenal C
Wheeler, Dr. R. E., Howard College, Birmingham PM
White, Horace Gene, 23 Southmont Drive, Tuscaloosa GA
White, Locke, Jr., Southern Research Institute, Birmingham C
Whiteford, Dr. Robert D., Auburn University MS-BS-SE

Whitehead, Dr. Fred, 3496 Cloverdale Road, Montgomery C
Whitfield, James W., Box 134, Eutaw .... GA
Whitt, Carlton D., Chemstrand Corporation, Decatur C
*Whittaker, Fred, Hewitt-Trussville High School, Trussville .... SE
Widdowson, Dr. David C., 1121 North Three Notch Street, Troy .... BS
Wiese, Peter V., Box 2251, Montgomery .... GA
Wilcox, Harold E., Birmingham-Southern College, Birmingham C
Wilkes, Dr. James C., Mississippi State College for Women,
Columbus, Miss. .... BS
Wilkes, Dr. William T., Troy State College, Troy .... SE-PM
*Williams, W. L., Oxford High School, Oxford .... SE
**Williford, Ernest John, 725 Clayton Street, Montgomery .... C-BS
*Williford, John, Hayneville High School, Hayneville .... SE
Wilson, Dr. Hazel Schoonmaker, Jacksonville University,
Jacksonville 11, Fla. .... PM
Wilson, Dr. L. T., Jacksonville University, Jacksonville 11, Fla. .... PM
Wimberly, Steve B., Route 13, Box 718, Birmingham 13 .... GA
Wingard, R. E., Box 177, Auburn C
Wingo, William J., University Medical Center, Birmingham .... MS
Winkler, Dr. Charles H., Jr., University Medical Center, Birmingham MS
Winsor, Carlton W., 3700 The Cedars, Spring Hill Station, Mobile BS-MS
Wintter, J. E., Howard College, Birmingham .... MS
Wood, George W., Jr., Route 2, Box 14, Cottondale, Alabama ....
Woods, James W., University Medical Center, Birmingham ....
Woolley, Mrs. Carolyn W., Box 387, Ashville Road, Montevallo .... SE

Y

Yackzan, Kamal S., Alabama College, Montevallo .... BS-C-MS
†Yancey, Patrick H., Spring Hill College, Mobile .... BS
**Yarbrough, Miss Glory, 1928 East Blount Street, Pensacola, Fla. .... C-BS
Yates, Mrs. Jane C., 2529 Park Lane Circle, Birmingham .... BS
**Yates, Robert D., 2529 Park Lane Circle, Birmingham .... MS
Yeager, Dr. Joseph H., Auburn University .... SS
Yerby, Miss Gail, 2030 Highland Avenue, Apt. C-3, Birmingham 5 BS-SE
Yocom, Herbert A., 315 16th Street, S.W., Birmingham .... FGC
Youngblood, Robert W., 626 South 54th Street, Birmingham .... SE

Z

Zagarra, Dr. Manuel, 2100 10th Avenue South, Birmingham .... SE

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal, should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

Office of the Editor
Howard College
Birmingham, Alabama

VOLUME 32 JULY, 1961 NUMBER 3

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 32 JULY, 1961. NUMBER 3

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

OFFICERS OF THE ALABAMA ACADEMY OF SCIENCE 1961-1962

President .... Paul C. Bailey, Alabama College, Montevallo

President-elect .... Rev. Louis J. Eisele, S. J., Spring Hill College, Mobile

Immediate past-president .... James R. Goetz, 2021 Sixth Ave. N, Birmingham

Secretary .... W. B. DeVall, Auburn University

Treasurer .... William J. Barrett, Southern Research Institute, Birmingham

Editor of Journal .... Clarence C. Hall, Jr., Howard College, Birmingham

Archivist .... Clyde H. Cantrell, Auburn University

Editor of Newsletter .... Mrs. Carol Ann Padgett, Huntingdon College, Montgomery

Councilor of A. A. A. S. .... Patrick H. Yancey, S. J., Spring Hill College, Mobile

Permanent Counselor of the Junior Academy .... Ruric Wheeler, Howard College, Birmingham

Associate Counselors of the Junior Academy .... Reuben Boozer, Jacksonville State College
D. F. Butler, Troy State College

Coordinator of Science Fairs .... George O. Twellmeyer, S. J., Spring Hill College, Mobile

SECTION VICE-PRESIDENTS AND VICE-CHAIRMEN

Section I
Biological Sciences .... Vice-President and Section Chairman, Herbert Boshung, Jr., University of Alabama

Vice-Chairman, J. Richard Thomson, Southern Research Institute, Birmingham

Section II
Chemistry .... Vice-President and Section Chairman, Paul Melius, Auburn University

Vice-Chairman, Robert H. Garner, University of Alabama

Section III
Geology and Anthropology .... Vice-President and Section Chairman, W. T. Daniel, University of Alabama

Vice-Chairman, A. T. Hansen, University of Alabama

Section IV
Forestry, Geography and Conservation .... Vice-President and Section Chairman, John M. McCullough, 2844 Spann Place, Montgomery

Section V
Physics and Mathematics .... Vice-President and Section Chairman, Howard Carr, Auburn University

Vice-Chairman, Roscoe Kelley, Troy State College

Section VI
Industry and Economics .... Vice-President and Section Chairman, John Baswell, 5613 Tenth Ave. S., Birmingham

Section VII
Science Education .... Vice-President and Section Chairman, Mrs. Mary E. Ward, P. O. Box 196, Wilmer

Vice-Chairman, James M. Bowles, Box 1475, Mobile

Section VIII
Social Sciences .... Vice-President and Section Chairman, James F. Doster, P. O. Box 1955, University

Vice-Chairman, Chester W. Hartwig, Auburn University

Section IX
Medical Sciences .... Vice-President and Section Chairman, William J. Wingo, Medical Center, Birmingham

BOARD OF TRUSTEES

PROGRAM

THIRTY-EIGHTH

ANNUAL MEETING

of the

Alabama Academy

of

Science

With The

GORGAS SCHOLARSHIP FOUNDATION

And The

ALABAMA JUNIOR ACADEMY OF SCIENCE

APRIL 7-8, 1961

SPRING HILL COLLEGE

Mobile, Alabama

PROGRAM

of the

ALABAMA ACADEMY OF SCIENCE

Thursday, April 6

6:30 P.M.—Dutch dinner for members of the Executive Committee .... SHC Cafeteria

8:00 P.M.—Executive Committee open meeting
Room 101, Yenni Hall

Friday, April 7

8:30 A.M.—Registration .... Lounge, Walsh Hall

9:30 A.M.—Section Meetings
- I. Biological Sciences .... Room 101, Yenni Hall
- II. Chemistry .... Room 103, Chemistry
- III. Geology and Anthropology .... Room 122, Physics
- VI. Industry and Economics*
- VIII. Social Sciences .... Room 121, Physics
- IX. Medical Sciences .... Room 103, Chemistry
  (Joint meeting with Section II, Chemistry.)

1:00 P.M.—Lunch .... SHC Cafeteria

2:30 P.M.—Section Meetings
- I. Biological Sciences .... Room 101, Yenni Hall
- II. Chemistry .... Room 103, Chemistry
  (Joint meeting with Section IX, Medical Sciences)
- III. Geology and Anthropology .... Room 122, Physics
- IV. Forestry, Geography and Conservation .... Room 126, Chemistry
- V. Physics and Mathematics .... Room 131, Physics
- VIII. Social Sciences .... Room 121, Physics
- IX. Medical Sciences .... Room 103, Chemistry

4:00 P.M.—Business Session .... Room 101, Physics

4:00-5:00 P.M.—Junior Academy of Science exhibits open to Academy members and the public
Rooms 106, 113, Chemistry

Alabama Junior Academy of Science
Ft. Hardeman Armory

* Section VI, Industry and Economics, has scheduled no formal program. It functions as a promotional agency of the Academy.

Guest Speaker: Dr. Joachim P. Kuettner, of the George C. Marshall Space Flight Center, Huntsville, Alabama. His topic will be "Man Into Space."
Host: E. H. Sargent and Company

Saturday, April 8

8:00-12:00 Noon—Exhibits of Alabama Junior Academy of Science open to Academy members.....Rooms 106, 113, Chemistry
9:00 A.M.—Section Meetings
I. Biological Sciences..............................Room 101, Yenni Hall
III. Geology and Anthropology....................Room 122, Physics
V. Physics and Mathematics......................Room 131, Physics
VII. Science Education..College Inn
IX. Medical Sciences......................................Room 101, Physics
(Meet jointly with Alabama Junior Academy of Science)
10:00 A.M.—Joint meeting of Alabama Junior Academy of Science and Alabama Academy of Science......................College Inn
—Presentation of officers, Alabama Junior Academy of Science
—Presentation of State and Regional Counselors and Regional Presidents, Alabama Junior Academy of Science
—Announcements
12:00 Noon—Adjourn

Gorgas Scholarship Foundation

Thursday, April 6

(Selection of Winners of Alabama State Science Talent Search for General Gorgas Scholarships)
5:00 P.M.—Demonstration of exhibits to judges—Chemistry Building, Rooms 106 and 113
6:30 P.M.—Banquet for finalists and judges—Faculty Common (SHC)
8:00 P.M.—Personal interviews of finalists by judges—Chemistry Building, Room 113

Alabama Junior Academy of Science

Friday, April 7

8:00 A.M.—Registration..Battle House Hotel or College Inn (SHC)

9:00 A.M.—Preparation of exhibits .... Chemistry Building, Room 106 and 113

10:00 A.M.—Caucus of officers and official delegates .... College Inn

10:00 A.M.—Conference of sponsors and counselors .... Physics Building, Room 102

10:45 A.M.—Business Session .... College Inn

12:00 Noon—Luncheon for Executive Committee .... St. Paul's Parish House

1:30 P.M.—Tours .... Brookley Air Force Base

3:00 P.M.—Judging of exhibits .... Chemistry Building, Rooms 106 and 113

7:00 P.M.—Annual dinner for Alabama Academy of Science and Alabama Junior Academy of Science
Fort Hardeman Armory

(Immediately following this dinner the Junior Academy of Science enjoyed a party in the Fort Hardeman Armory.)

Saturday, April 8

8:00 A.M.-12:00 Noon—Exhibits will be on display .... Chemistry Building, Rooms 106 and 113

8:30 A.M.—General Assembly—Presentation of Scientific papers by Regional Finalists .... College Inn

9:00 A.M.—Business Meeting .... College Inn

10:00 A.M.—Joint meeting of Alabama Academy of Science and Alabama Junior Academy of Science .... College Inn

12:00 Noon—"Dutch Treat Luncheon" for Old and New Executive Committee Members .... College Cafeteria

Section Meetings

9:30 A.M. Friday, April 7

SECTION I, BIOLOGICAL SCIENCES

Room 101, Yenni Hall

William D. Ivey, Vice President

1. **An Analysis of the Herpetofauna of Dauphin Island.**
   Ralph L. Chermock, University of Alabama.
2. **Macroscopic and Microscopic Anatomy of the Canine Eye.**
   R. D. Whiteford, Auburn University.
3. **Post-Natal Development of the Canine Eye.**
   R. D. Whiteford, Auburn University.
4. **Tree Cancers.**
   Roland M. Harper, Geological Survey of Alabama.

5. **Interesting Flora on Dauphin Island.**
Blanche E. Dean, Birmingham, Alabama.
6. **The Influence of Plant Residues on the Growth of Sclerotium Rolfsii in vitro.**
Aubrey C. Mixon, Auburn University.
7. **A Severe Case of Congenital Diaphragmatic Hernia in the Domestic Cat.**
Herbert Boschung and James Yarbrough, University of Alabama.
8. **Fishes Endemic to the Coosa River.**
Herbert Boschung, University of Alabama.
Business Meeting.

SECTION II, CHEMISTRY
Room 103, Chemistry
Charles E. Feazel, Vice President

1. **The Effect of Desoxycorticosterone Acetate (DOCA) on Glycogen Formation in Liver and Skeletal Muscle of the Albino Rat.**
William Niedermeier, University of Alabama Medical Center.
2. **The Use of Inclusion Compounds to Control Carbohydrate Reactions.**
Harmon L. Hoffman, Jr., Southern Research Institute.
3. **Far Infrared Spectra of Purine and Some of Its Deuterated Derivatives.**
W. Ray Laseter and W. C. Coburn, Jr., Southern Research Institute.
4. **The Mystery of Catalase.**
Henry Ross Miller, Shades Valley High School.
5. **Coupling Reactions of 5-Diazoimidazole-4-carboxamide.**
Charles A. Krauth, Y. Fulmer Shealy, and John A. Montgomery, Southern Research Institute.
6. **Synthesis of Potential Anticancer Agents. Fraudulent Nucleotides Derived from 6-Mercaptopurine.**
Jeanette Thomas and John A. Montgomery, Southern Research Institute.
7. **Some Reactions of 5-Amino-4-Hydrazinopyrimidines.**
Carroll Temple, Jr., J. A. Montgomery, Southern Research Institute; R. L. McKee, Department of Chemistry, University of North Carolina.
8. **The Synthesis of 3'-Fluoropteroylglutamic Acid.**
James R. Piper, K. Hewson, and John A. Montgomery, Southern Research Institute.

9. **Surface Tension of Fatty Acid Solutions as a Function of the Molecular Weight.**
Alan Hisey, University of Alabama.
Business Meeting.

SECTION III, GEOLOGY AND ANTHROPOLOGY

Room 122, Physics

David L. DeJarnette, Vice President

1. **Some Significant Recent Changes in the Pattern of Coal Production and Markets in Alabama.**
Reynold Q. Shotts, University of Alabama.
2. **Weathering of Alabama Mica Feldspar Pegmatites.**
Hugh D. Pallister, Geological Survey of Alabama.
3. **Tuscaloosa Clays Guide Brown Iron Ore Exploration.**
Jack E. Morris, U.S. Pipe and Foundry Company.
4. **"Sink-hole" Bauzite Deposits in Northeastern Alabama.**
Otis M. Clarke, Jr., Geologist, Tuscaloosa, Alabama
5. **Copper-bearing Pyrite Deposit, Pyriton, Clay County, Alabama.**
Earl L. Hastings, Geological Survey of Alabama.
6. **Mineralogical Distribution and Weathering Relationship for Clayey Decatur Soils of the Limestone Valley Region of Alabama.**
Joe B. Dixon, Auburn University.
7. **Relation of the Geologic Structure of the Huntsville Area, Alabama, to the Occurrence of Ground Water in a Limestone Terrain.**
W. J. Powell and P. E. LaMoreaux, U.S. Geological Survey.
8. **Rotary Bucket Drilling Replaces Churn Drilling in Russellville.**
Jack E. Morris, U.S. Pipe and Foundry Company.
9. **Geological Report of the Russell Cave System in Alabama.**
Mr. J. M. McCullough, Chief Forest Management, Department of Conservation.
T. W. Daniel, Jr., and Walter B. Jones, Geological Survey of Alabama.

SECTION VIII, SOCIAL SCIENCES

Room 121, Physics

E. D. Chastain, Jr., Vice President

1. **New Viewpoints on the Two-Party System of the Ante-Bellum South.**
Thomas B. Alexander, University of Alabama.

*2. **Agricultural Research—A Contribution to Alabama Progress.**
Lillian F. Foscue, Auburn University.

3. **The Farm Bureau Federation and the Farm Bloc of 1921.**
Ralph Tanner, Birmingham-Southern.

4. **Credit Problems in Financing Homes in Rural Areas of the Southeast.**
Joseph H. Yeager, Auburn University.

5. **Alabama State Bond Ratings and the Alabama Debt Structure.**
Joseph M. Bonin, Auburn University.

6. **A Behavioral Model of Ontogeny.**
Eleazer C. Overton, O.D., and Glen W. Herren, O.D., Practicing Optometrists, Birmingham.

SECTION IX, MEDICAL SCIENCES

Room 103, Chemistry
Roger W. Hanson, Vice President

JOINT MEETING WITH SCTION II, CHEMISTRY

2:30 P.M., Friday, April 7

SECTION I, BIOLOGICAL SCIENCES

Room 101, Yenni Hall
William D. Ivey, Vice President

1. **Comparison of the Chemical Composition of Three Varieties of Runner Peanuts.**
N. D. Davis, Auburn University.

2. **Growth of Storage Fungi on Media Containing Fatty Acids.**
U. L. Diener and N. D. Davis, Auburn University.

3. **The Utilization of Transplantable Hamster Tumors as a Tool for Evaluating Potential Anticancer Agents.**
J. Richard Thomson, Southern Research Institute.

4. **Summer Research in a Physiology Laboratory.**
Pauline K. Long, Woodlawn High School.

5. **Tests of Ultrasound on Nematodes.**
E. J. Cairns, Auburn University.

6. **The Comparative Blood Composition of Brahman and Hereford Cattle.**
J. R. Howes, Auburn University.

---

*This paper is an entry for the graduate student research award.

SECTION II, CHEMISTRY

Room 103, Chemistry

Charles E. Feazel, Vice President

JOINT MEETING WITH SECTION IX—MEDICAL SCIENCES

SECTION III, GEOLOGY AND ANTHROPOLOGY

Room 122, Physics

David L. DeJarnette, Vice President

1. **A Study of the Wormian Bones in Eight Indian Skulls.**
   Robert D. Yates, University of Alabama Medical Center.
2. **Archeology, Psychology, and the Beginnings of Culture.**
   A. T. Hansen, University of Alabama.
3. **Ethnology and the USAF.**
   Paul H. Nesbitt, Air University, Maxwell A.F. Base.
4. **Growth in the Chimpanzee of the Pelvis and Spine.**
   Charles W. Moulthrop and E. Carl Sensenig, University of Alabama Medical Center.
5. **Anthropometric and Photographic Methods.**
   William J. Griffin, and E. Carl Sesenig, University of Alabama Medical Center.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

Room 126, Chemistry

Vernon J. Knight, Vice President

Theme: "A Look at the Gulf Coast Region of Alabama."

1. **Alabama's Gulf Coast—The Geographical Setting.**
   J. Allen Tower, Birmingham-Southern.
2. **Forestry and Agriculture in Baldwin County.**
   F. C. Turner, County Agent, Baldwin; Knox Davis and Bill Friel.
3. **Soil and Water Conservation in the Gulf Coast Region.**
   W. T. Brown, Soil Conservation Service.
4. **Industrial Development of the Mobile Area.**
   William A. Riggs, Engineer, Resources and Industrial Development, Gulf, Mobile and Ohio Railroad Co.
5. **Measurement of Forest Fire Danger and Its Application in Fire Prevention and Control.**
   C. F. Attaway, Chief Forest Fire Control, Department of Conservation.

6. **Bottomland Hardwood Management.**
J. M. McCullough, Chief, Forest Management, Department of Conservation.
7. **Forest Tree Diseases in Alabama.**
W. H. Padgett, Chief, Entomology and Pathology, Department of Conservation.

SECTION V, PHYSICS AND MATHEMATICS
Room 131, Physics
L. J. Eisele, S.J., Vice President

1. **Some Conchoids of an Ellipse.**
Roland M. Harper, University, Alabama.
2. **Vortex Formation of Turbulence.**
A. E. Elkayar, Auburn University.
3. **Freshman Experiments on Magnetism.**
L. J. Eisele, S.J., Spring Hill College.
4. **Mathematics and Physics in the Universities of Columbia.**
W. L. Furman, S.J., Spring Hill College.
5. **Electroluminescence in the Ultraviolet.**
John A. Detrio, University of Alabama.
Business Meeting.

SECTION VIII, SOCIAL SCIENCES
Room 121, Physics
James F. Doster, Vice Chairman

1. **The Social Sciences at Spring Hill College.**
Roy Vollenweider, S.J., Spring Hill College.
2. **Credit Unions in Southern Industry.**
H. Ellsworth Steele, Auburn University.
3. **Collective Bargaining Problems of Supplemental Unemployment Benefits.**
Truly E. Kincey, Auburn University.
4. **The Henry Ford Proposal for Muscle Shoals, 1921-24.**
Adrian George Daniel, Florence State College.

*5. **The Economic Adaptability of the Corporate Form of Business Organization to Family Farms.**
W. Fred Woods, Auburn University.

6. **The Emerging Role of the Sociologist.**
Chester W. Hartwig, Auburn University.

---

*This paper is an entry for the graduate student research award.

SECTION IX, MEDICAL SCIENCES
Room 103, Chemistry
Roger W. Hanson, Vice President

1. **Edward Henry Cary.**
Emmett B. Carmichael, University of Alabama Medical Center.
2. **X-Ray Methods of Crystal Structure Determination.**
Harold E. Wilcox, Birmingham-Southern College.
3. **In Vitro Changes in the Staining of Dental Pulp.**
M. B. Quigley and A. Curtis, University of Alabama Medical Center.
4. **A Biochemical Basis for the Resistance of Some Mouse Neoplasms to 6-Thioquanine.**
Patricia Stutts, Southern Research Institute, Birmingham, Ala.
5. **Carcinogenic Activity of Nucleic Acid Extracts from Neoplastic Cells.**
Bettie Duncan, G. J. Dixon and F. M. Schabel, Jr., Southern Research Institute, Birmingham, Alabama.
6. **Organization of Cardiogenic Capacity.**
Lowell M. Duffy, University of Alabama Medical Center.
7. **Synergistic Inhibition of Bacteria by Combinations of Actinobolin and Certain Purine Analogues.**
Robert F. Pittilo and Barbara G. Quinnelly, Southern Research Institute, Birmingham, Alabama.
Business Meeting.

9:00 A.M., Saturday, April 8

SECTION I, BIOLOGICAL SCIENCES
Room 101, Yenni Hall
William D. Ivey, Vice President

1. **An Interspecific Hybrid in Vicia.**
E. M. Clark, Auburn University.
2. **Modification of the Dilution-Plate Method for Isolating Soil Fungi.**
Norman C. Schenck and E. A. Curl, Auburn University.
3. **A Note on Hepatic Cysticercosis, with the Proposal of a New Variety of Taenia saginata.**
Emmett W. Price, Jacksonville State College.
4. **Studies on Drosophilia of Alabama.**
William Guest, University of Alabama.

5. **An Interrelation Between the Thyroid and Adrenal Gland.**
K. Ottis, Auburn University.
6. **The Auburn Environmental Chambers for Avian Physiological Research.**
J. R. Howes, W. Grub and C. A. Rollo, Auburn University.

SECTION III, GEOLOGY AND ANTHROPOLOGY
Room 122, Physics
David L. DeJarnette, Vice President

Symposium: Indian Pottery of South Alabama.

1. **Early and Late Indian Pottery of the Mobile Bay Area.**
Steve B. Wimberly, Birmingham Anthropological Society.
2. **Early and Late Indian Pottery of the Chattahoochee Area.**
Edward B. Kurjack, University of Alabama.
3. **Discussion of Papers by Wimberly and Kurjack.**
E. Bruce Trickey, Mobile, Alabama.
4. **Coevality of Soapstone Vessels and Early Indian Pottery.**
David L. DeJarnette, University of Alabama.

SECTION V, PHYSICS AND MATHEMATICS
Room 131, Physics
L. J. Eisele, S. J., Vice President

1. **Student Research Project: Counting Atmospheric Neutron.**
E. E. Sommerfeldt, S.J., Spring Hill College.
2. **Student Research Project: Meson Measurements.**
V. J. Newton, S.J., Spring Hill College.
3. **Application of the Reversible Pump-Turbine Units in Hydro-Electric Power Plants.**
A. E. Elkayar, Auburn University.
4. **Large Volume Water Cerenkov Detector.**
Harry Weaver, Auburn University.
5. **Coincidence Scintillation Spectrometer with Photographic Recording.**
Richard Fearn, Auburn University.
6. **Observations on X-Ray Diffraction Patterns of Egg Shell.**
Charles Cain, Auburn University.

10:00 A.M.

SECTION VIII, SCIENCE EDUCATION
College Inn
Jerome Kuderna, Vice President

(Joint meeting with the Alabama Academy of Science and the Alabama Junior Academy of Science.)

1. **Values of the Alabama Junior Academy of Science.**
   Marvin Uphouse (President, 1957-58), Theresa Hagendoff (President, 1958-59), and Eric Revere (Vice-President, 1958-59).
2. **Science Project Display—Initiating and Developing a Project in High School Science.**
   Discussion by a Mobile Science Teacher.
   Business Meeting.

SECTION IX, MEDICAL SCIENCES
Room 101, Physics
Roger W. Hanson, Vice President

1. **A Simple Device for Saturating Blood with Gases.**
   Walter Johnson, University of Alabama Medical Center.
2. **The Influence of Ovarian Hormones on Hamster Submaxillary Mucin.**
   John M. Shackleford and C. E. Klapper, University of Alabama Medical Center.
3. **Effects of Section of the Spinal Dorsal Roots in Cats.**
   H. H. Hoffman and E. G. Hamel, Jr., University of Alabama Medical Center.
4. Glycogen Content of Thyroid Tissues.
   W. E. Martindale, J. A. Pittman, Jr., and W. J. Wingo, Radioisotope Service, V.A. Hospital and Departments of Medicine and Biochemistry, University of Alabama Medical Center.

FALL EXECUTIVE COMMITTEE MEETING

Howard College, Birmingham, December 3, 1960

The meeting was called to order at 9:05 a.m. by James R. Goetz, President.

The following members of the Executive Committee were present. Paul C. Bailey, Samuel B. Barker, William J. Barrett, Reuben B. Boozer, Howard Carr, Thomas W. Daniel, Jr., David L. DeJarnette, W. B. DeVall, James F. Doster, C. E. Feazel, John A. Fincher, James R. Goetz, A. T. Hansen, Roger W. Hanson, A. F. Hemphill, Frances D. Jones, Vernon J. Knight, H. A. McCullough, J. Allen Tower, George O. Twellmeyer, S.J., Mrs. Mary E. Ward, Ruric Wheeler, Locke White, Jr., Carlton Whitt. Guests present were John F. Odom and Gibbes Patton.

The President called for a reading of the minutes of the March 31, 1960 Executive Committee Meeting and the minutes of the April 2, 1960 Annual Business Meeting.

The Secretary read the minutes, exclusive of committee reports. The second sentence of the final paragraph on page 17 of the April 2 minutes was corrected to read as follows:

> "He stated that Mrs. Lucille Lloyd will serve as Chairman of Local Arrangements for the Academy and that Dr. Francis Kearley will serve as Chairman of Local Arrangements for the Junior Academy."

President Goetz declared the minutes approved as corrected.

President Goetz reported on his goals for the year, which were to strengthen membership, to seek endowment financing of the Academy, to explore ways of extending the Academy's interest and program to industry, and to give the Academy more adequate publicity. He stated that because of economic conditions, funds in support of the Academy's program have not been forthcoming. Additional contacts will be made and a further report presented at the Spring Meeting of the Executive Committee. Dr. McCullough commented on efforts to secure funds in support of science fairs as a part of the Academy program. He stated that there was in prospect one new industrial member.

President Goetz called for reports of officers.

Report of the Secretary by Dr. DeVall.

Since the 1960 Annual Meeting routine duties have been performed by the Secretary. All vice presidents and vice chairmen of sections were advised of their duties in the Academy.

Centralized mailing services have been handled by the Secretary. Since April 1, two issues of the Newsletter and one issue of the Journal have been mailed to the membership.

By authorization of the President the Minute Book, kept by previous secretaries was discontinued. It will be turned over to the Archivist if this action is authorized by the Executive Committee. Minutes are now being kept in looseleaf form. All reports are now incorporated in the minutes rather than being "pasted" in a bulky ledger-style book.

The Academy has acquired some additional property. Three 4-drawer file cabinets were purchased. Two are in use by the Archivist and one by the Secretary.

New letterhead has been purchased and mimeographed correspondence is now being prepared on mimeograph letterhead. (See agenda for December meeting.)

Motion No. 52. Motion by Dr. Barker, seconded by Dr. Hansen, that the report by the Secretary be accepted. Motion passed unanimously.

Report of the Treasurer by Dr. Barrett.

The Treasurer's report covered the period April 1, 1960 through November 7, 1960.

BALANCE April 1, 1960			$3509.38
RECEIPTS			
Dues		$ 419.00	
Annual Meeting			
Contribution of E. H. Sargent and Company for Banquet	$ 418.08		
Banquet Tickets Sold	359.10		
Registration Fees	390.00		
	1167.18	1167.18	
Gifts		70.00	
AAAS Research Grant		150.00	
Sale of Journals		12.00	
Interest on Savings Account		49.19	
Total		1867.37	1867.37
			Total 5376.75
EXPENDITURES			
Publication of Journal		$ 358.48	
Assistance to Junior Academy		450.94	
Operating Expense		540.33	
Research Grants		475.00	

Student Awards		90.00	
Annual Meeting			
Meeting Expense	$ 18.58		
Programs	184.76		
Banquet	1210.56		
	1413.90	1413.90	
Total		3328.65	3328.65
BALANCE November 7, 1960			
Checking Account		$ 498.91	
Savings Account		1549.19	
		2048.10	2048.10
		Total	5376.75

The proposed budget for the Fiscal Year 1961 is as follows:

Anticipated Income

Membership Dues		$1800.00
Registration Fees, Annual Meeting		300.00
Gifts		100.00
Journal Sales		25.00
Interest		40.00
	Total	2265.00

Anticipated Expense

Publication of Journal			750.00
Assistance to Junior Academy			
Academy Award Winner	Individual	$ 25.00	
	School	25.00	
Awards for Papers		25.00	
Awards for Exhibit Winners		100.00	
Cups		150.00	
Pins or Keys		45.00	
Contribution to AJAS Budget		20.00	390.00
Student Research Awards			100.00
Research Grants			400.00
Academy Conference Assessment			10.00
Annual Meeting			
Programs and Other Expenses		300.00	
Banquet Meals for AJAS		500.00	800.00
Operating Expense			
Office of President		100.00	
Offices of Secretary and Treasurer		200.00	
Office of Coordinator of Science Fairs		50.00	
Office of Editor of Journal		150.00	
Office of Permanent Counselor to Junior Academy		80.00	
Newsletter		75.00	655.00
		Total	3105.00
ANTICIPATED EXCESS OF EXPENSE OVER INCOME			840.00

Motion No. 53. Motion by Dr. McCullough, seconded by Father Twellmeyer, that the report of the Treasurer be accepted and funds be allocated in the 1961 budget for the Junior Academy banquet with minor changes in other amounts for the Junior Academy.

The Treasurer was called on to discuss the budget for the Fiscal Year 1961.

Motion No. 54. Motion by Father Twellmeyer, seconded by Mr. Hemphill, that Motion No. 53 be temporarily tabled until sources of income could be discussed. Motion passed unanimously.

The discussion covered the need to increase income to adequately support the Junior Academy and normal operating expenses of the Senior Academy.

Motion No. 55. Motion by Dr. Barker, seconded by Dr. McCullough that the Finance Committee study potential sources of income and report its findings at the Spring Meeting of the Executive Committee, that the Membership Committee renew its activities as a source of income, and that $500 be incorporated in the 1961 budget as a contribution toward the cost of the Junior Academy Banquet. Motion passed unanimously.

Motion No. 56. Motion by Dr. Barker, seconded by Dr. Fincher, that Motion No. 53 be recalled. Motion passed unanimously.

Motion No. 53 recalled. Motion passed unanimously.

Report of the Councilor of the A. A. A. S. read by Mr. Hemphill for Yancey.

> Since there has been no meeting of the A. A. A. S. since the last meeting of the Executive Committee, I have no report to make except to state that I shall attend the A. A. A. S. convention in New York December 26-30.
>
> In connection with the forthcoming meeting, there will be some amendments to the Constitution and By-Laws of the A. A. A. S. (See *Science*, Nov. 25, p. 1558) coming up for a vote in the Council. If the Executive Committee has any instructions for me in this matter, please let me know.
>
> It might also be of interest that I have been appointed by President Chauncey Leake to the A. A. A. S. Council Study Committee on Research in Small Colleges.

Motion No. 57. Motion by Dr. Hanson, seconded by Mr. Patton, that the report of the Councilor be accepted. Motion passed unanimously.

Report of the Editor by Dr. Hansen.

> The Journal is considerably behind schedule due to a number of factors. When the Editor agreed to undertake the job, he knew that some already existing professional commitments would have to be given priority for awhile. As often happens, they consumed more time than had been anticipated. Urgent family business required his absence from the state and region for five of the weeks he was free of teaching during

the summer. Being a beginner, he had a good deal to learn about editing and even more about printing. The printer had troubles too. The material for the first issue reached him belatedly and caught him in such a busy period that there was further delay.

But all is not lost. The presses will be running off the July issue within a few days. Preparation of the October number is nearing completion. By devoting most of the Christmas vacation to the Journal and by taking full advantage of the brief break between semesters, the Editor still entertains the hope that the Journal will be current by April, 1961.

Motion No. 58. Motion by Dr. Bailey, seconded by Dr. Fincher, that the report of the Editor be accepted and that the Executive Committee commend him for his loyal service. Motion passed unanimously.

Report of the Counselor of the Junior Academy of Science by Dr. Wheeler.

The Executive Committee of the Alabama Junior Academy of Science held its annual fall meeting November 5, 1960, on the Spring Hill Campus with Professors Kearly and Hemphill, Local Counselors. All officers and sponsors (with the exception of Mr. C. J. McSpadden) were present. Mrs. Lucille Lloyd, Regional Counselor of the Mobile Region, and Professor Spencer, Regional Counselor of the Southeastern Region, were also in attendance. Plans for the annual meeting of the Alabama Junior Academy of Science were discussed. The following items are herewith submitted to the Executive Committee, Alabama Academy of Science, for action:

1. The Alabama Junior Academy of Science annual meeting should be held concurrently with the Senior Academy. The recommended place and date of meeting: Spring Hill College, April 7-8, 1961.
2. The officers, sponsors, and counselors of the Junior Academy recommend a combined banquet of both Senior and Junior Academy members to be held at the annual convention in 1961.
3. The following budget, to be underwritten by the Senior Academy, is submitted for action of the Executive Committee:

I. Awards at the Annual Convention	
A. Exhibits: First place winners in four categories:	
Biology	$ 25.00
Chemistry	25.00
Mathematics and Industry	25.00
Physics	25.00
B. Cash Award, best scientific paper	25.00
C. Academic Award Winner, Individual	25.00
D. Academic Award Winner, School	25.00
E. Purchase of ten cups for exhibits and papers	150.00
F. Purchase of four pens or keys for AJAS officers	20.00
G. Lettering on plaque and on cups, etc.	25.00
II. General Expense Account, Permanent Counselor	80.00
III. To underwrite AJAS budget ($425)	20.00
	$470.00

4. A combined meeting for members of Alabama Junior Academy of Science and one of the sections of the Senior Academy will be welcomed as a continued feature of the tentative program.

5. The Special Projects Section of the National Science Foundation has been contacted concerning financial assistance in order to increase the Junior Academy of Science activities in Alabama. If an application is submitted, it will cover one or more of the following items.

   I. If financial help can be obtained, a three day pre-school workshop will be held for all officers of AJAS and their sponsors, the regional officers and sponsors, the regional counselors, the state counselors, the science fair coordinators, etc. Such a workshop would be of much value in coordinating the work of the five regions in the state and would undoubtedly improve the AJAS program.

   II. The Alabama Junior Academy of Sciene desires to increase its service in the field of science and mathematics by sponsoring an Alabama Mathematics Contest. Contests would be held in the five regions with the winners in the regions participating in the state contest which would occur at the time of the state convention.

   III. Many high schools want assistance in organizing clubs, planning projects, etc.; others desire lectures on specialized topics. We have in Alabama a number of qualified scientists who would be happy to give the assistance and lectures without charge if the Alabama Junior Academy of Science could finance their travel expenses. An extensive lecture series and technical assistance program for the high schools of Alabama could be organized with proper financial support.

As a matter of information to members of the Senior Academy, the following Regional Counselors have been appointed:

1. Dr. Harold Strickland, Northeast Region of the AJAS.
2. Mrs. Ibbie K. Bradford, North Region of the AJAS.
3. Mrs. Lucille Lloyd, Mobile Region of the AJAS.
4. Professor G. O. Spencer, Southeast Region of the AJAS.
5. Miss Clustie McTyeire, Central Region of the AJAS.

The Counselor wishes to solicit pertinent suggestions that will contribute to the continued growth of the Junior Academy and to express appreciation for the enthusiastic support and interest expressed by the Senior Academy.

Motion No. 59. Motion by Dr. Carr, seconded by Dr. Barker, that the report of the Counselor be accepted. Motion passed unanimously.

Report of the Coordinator of Science Fairs by Father Twellmeyer.

GENERAL

Alabama State Delegation To The National Science Fair

The Committee on Regional Science Fairs, at its meeting of March 31, 1960, approved the arrangement whereby all of the regional delegations will attend the National Science Fair as a State Delegation. The finalists from all the regions will be supervised by two official chaperones representing the Committee on Regional Science Fairs of the Alabama Academy of Science. This procedure is in accord with the resolution of the Science Fair Council of the National Science Fair which reads "any student participating in the National Science Fair should be supervised by an adult."

The finalists from the Alabama Regional Fairs to the 1960 National Science Fair in Indianapolis, Indiana, are as follows:

North Region
- Linda Darwin Smith, Coffee High School, Florence
- David Joel Wilson, Athens High School, Athens

Northeastern Region
- Omer Lee Burnett, Jr., Sylacauga High School, Goodwater
- John Martin Cone, Jr., Anniston High School, Anniston Ordnance Depot

North Central Region
- Norman D. McCoy, Jr., Ramsay High School, Birmingham
- Wynne Hadley Alexander, Tuscaloosa High School, Tuscaloosa

Mobile Region
- John Marshall Crowell, Murphy High School, Mobile
- Eleanor Ann Fegerstrom, Theodore High School, Theodore

Southeastern Region
- William Price Cargile, Sidney Lanier High School, Montgomery

Finalists from Alabama took three awards at the 1960 National Science Fair. A second-place award in the physical sciences went to David Joel Wilson, Jr., Athens High School, Athens, of the North Region. A fourth-place award in the physical sciences went to Omer Lee Burnett, Jr., Sylacauga High School, Sylacauga, of the Northeastern Region. A National Navy Science Cruiser Award went to John Martin Cone, Jr., Anniston High School, Anniston, of the Northeastern Region. The Northeastern Region is to be congratulated on taking two awards at the National Science Fair since this is their first year of participation. Only two other Alabama Science Fair Awards have been received by finalists from Alabama Regional Fairs. The first was in 1955, when Kay Cowan of Bessemer High School received a fourth-place award. In 1956 Segail Irwin of Ensley High School also received a fourth-place award.

Solicitation of Funds From State-Wide Industry

The Science Fair Committee approved a resolution whereby the State Coordinator was instructed to request a thousand dollars annually from the Alabama Power Company, Alabama Gas Corporation, and the Southern Bell Telephone Company as a contribution to the Regional Science

Fairs of Alabama. At the suggestion of Mr. James R. Goetz, the matter is hereby being brought before the Executive Committee for approval before any action is taken on it.

REPORTS ON THE SCIENCE FAIR REGIONS

Formal annual reports have been received from all the five regional fair coordinators in Alabama. All of the regions have reported the number of projects entered in the various fairs or have given a listing of these projects.

A summary of these reports follows:

1. All regional fairs in Alabama contracted with Science Service to send finalists to the 1960 National Science Fair in Indianapolis.
2. All of the regional science fairs now have active regional Junior Academy Organizations with which to co-operate. This should bring about an increase in Junior Academy Science Fair activity in the regions.
3. The various regions report from twenty-two to thirty-five participating schools for the 1960 regional science fairs.
4. The number of projects entered in the various fairs was from 147 to 314.
5. Of the five regions reporting on their financial condition, four show a cash balance for their 1959-60 operation. The North Region has the largest balance with $875.79 reported. The Southeastern Region is next with a balance of $860.00. The Northeastern Region reports a balance of $105.87 and the North Central Region a balance of $16.69. The Mobile Region reports a deficit of $215.33 at the end of its 1959-60 operation. However, the deficiency reported at the end of 1958-59 was $636.81. Since this is a reduction in the deficit of over $400 during the last year's operation, this region should show a cash balance at the end of the 1960-61 operation.

Motion No. 60. Motion by Dr. Bailey, seconded by Dr. Barrett, that the report of the Coordinator be accepted and that the Executive Committee does hereby approve the proposal to solicit funds from statewide industry and that the administration of the program be in accordance with the published statement appearing on page 49, no. 2, and page 50, no. 3e of Volume 31, No. 1, of the Journal of the Academy. Motion passed unanimously.

Report of the Membership Committee by Dr. Bailey.

An active program will be launched soon after January 1 and section vice-chairman will be encouraged to solicit memberships by sections. The Secretary will provide each vice-president with the current list of members for his section.

The status of membership in the Senior Academy by sections as of December 3, 1960, is shown in the following tabulation.

Section		Individual		Collegiate		Hon.		Comp.		Life		Total	
No.	Name	As of Oct. 59	As of Dec. 60	As of Oct. 59	As of Dec. 60	As of Oct. 59	As of Dec. 60	As of Oct. 59	As of Dec. 60	As of Oct. 59	As of Dec. 60	As of Oct. 59	As of Dec. 60
I	BS	88	90	40	22	2	2	0	5	1	1	131	120
II	C	90	84	6	3	2	2	2	3	0	0	100	92
III	GA	22	44	11	5	0	1	0	0	1	0	34	50
IV	FGC	47	45	0	0	0	0	0	0	0	0	47	45
V	PM	41	40	7	2	1	1	0	2	0	0	49	45
VI	IE	33	24	0	0	1	1	0	0	1	2	35	27
VII	SE	19	22	2	2	0	0	41	52	0	0	62	76
VIII	SS	37	37	1	0	0	0	0	1	0	1	38	39
IX	MS	65	87	2	2	1	1	0	0	1	0	69	90
Total		442	473	69	36	7	8	43	63	4	4	565	584

Motion No. 61. Motion by Dr. Carr, seconded by Dr. Barker, that the report of the Membership Chairman be accepted. Motion passed unanimously.

Report of the Research Committee by Dr. Hanson for Sensenig.

A grant to Joe Allen Farmer, Graduate Student in Biology, University of Alabama, $75 to cover research project concerning "The Ecological Life History of *Croton Alabamensis*".

A grant to J. Allen Tower, Professor of Geography, Birmingham-Southern College, $200 for a study of "Agricultural Change in Alabama". Of this amount $150 came from A.A.A.S. and $50 from the research funds of the Alabama Academy of Science.

Motion No. 62. Motion by Dr. Hansen, seconded by Dr. Barker, that the report of the Research Committee be accepted. Motion passed unanimously.

Report of the Admissions to Membership Committee by Dr. Devall.

The Admissions to Membership Committee has considered applications or nominations for membership since the Fall executive meeting held October, 1959, as follows:

Individual 31 Honorary 1 Complimentary 20 Total 52

The minutes of the spring meeting of the Executive Committee called for a revision of the Application For Membership Form. The committee assumed that the revisions should be presented to the Executive Committee since any revision would require an expenditure of Academy funds for printing.

The committee recommends for Honorary Membership Dr. Walter B. Jones and Miss Winnie McGlamery, both of University, Alabama.

Motion No. 63. Motion by Dr. White, seconded by Dr. Barker, that the report of the Admissions to Membership Committee be accepted and that Dr. Walter B. Jones and Miss Winnie McGlamery be the two awarded honorary membership in the Academy according to Article I, 1, "e" of the By-laws. After discussion of the motion and the recommendations of the Committee for Honorary Membership, the motion passed unanimously.

Report of the Committee on Local Arrangements by Dr. Hemphill.

The committee for local arrangements consists of the following members:

Alabama Junior Academy of Science
Co-chairmen:
Mrs. Lucille Lloyd—housing, transportation and entertainment.
Dr. Francis J. Kearley—local program arrangements and exhibit space.

Alabama Academy of Science
Mrs. Ella D. Morris—registration
Mr. Paul J. Biebel—physical arrangements for sectional meetings (Biological Sciences; Forestry, Geography and Conservation; Medical Sciences).
Mr. Vernon H. Head—physical arrangements for sectional meetings (Chemistry, Physics and Mathematics; Geology and Anthropology).
Mr. Howard W. Smith—physical arrangements for sectional meetings (Science Education; The Social Sciences).
Dr. Carlton W. Winsor—arrangements for annual dinner.

General registration for the Alabama Academy of Science will be held in the lobby of the Spring Hill College physics building.

Sectional meetings will be scheduled, as far as possible, in the biology, chemistry, and physics buildings, with overflowing being accommodated in nearby classrooms.

Meetings of the Alabama Junior Academy of Science and the joint meetings of the Alabama Academy of Science and the Alabama Junior Academy of Science are scheduled to be held in the College Inn.

In addition to the downtown hotel and motel accommodations, members will find those motels which are located on either Alabama Highway 42 or U.S. Highway 90 West to be relatively convenient to the Spring Hill College Campus.

The Spring Hill College Cafeteria will be able to provide food service for academy members after 1:00 P.M. Friday, April 7, only if sufficient advance notice is given (an estimate, within 10%, of the expected number one week in advance). Otherwise, suitable places will be recommended.

The annual dinner will be held at the Fort Hardeman Armory on Forest Hill Drive. Morrison's Catering Service will provide the food. Anticipated costs are as follows:

Rental of armory—$60.00.

Table rental (4 persons per table or equivalent, including linens) —75 cents per table.

Approximate cost per plate including tip—$3.00.

Motion No. 64. Motion by Dr. Bailey, seconded by Dr. Hansen, that the report of the Local Arrangements Committee be accepted. After a discussion of the cost per person of the Annual Banquet and the need to contact the E. H. Sargent Company regarding its willingness to pay the total cost, the motion passed unanimously.

Report of the Editor of the Newsletter by Dr. Barker for Mrs. Padgett.

Mrs. Padgett was commended for having prepared and mailed two Newsletters since the last annual meeting of the Academy. Members of the Executive Committee were asked to renew their efforts to obtain news for the Newsletter.

Report of the Committee on Revision of the "History of the Alabama Academy" by Dr. Barker.

The special committee on editing the History of the Alabama Academy of Science named at the Spring 1960 meeting of the Executive Committee wishes to report that considerable progress has been made towards the praparation of a final manuscript for publication. Several people are working with us and each final chapter will be resubmitted to its original author.

We regret our inability to present such a completed document for this Fall 1960 Executive Committee Meeting, but aim to achieve this by the 1961 Spring Academy Meeting.

Motion No. 65. Motion by Dr. Carr, seconded by Dr. Wheeler, that the report of the special committee on the Academy's history be accepted. Motion passed unanimously.

The President called for reports from Section Vice-Presidents and Vice-Chairmen.

Report for the Physics and Mathematics Section by Eisele.

> I do have definite plans for the near future which should provide for a fairly good attendance at the forthcoming meeting and should provide quite a few papers. A rather informal and personal letter to the members of my section will be sent out as soon as the Christmas mail rush is over. This will be followed by a second letter later to remind the slow movers to help make the April meeting a success.

At the request of the Secretary, President Goetz asked the Committee to express its reaction to the recommendation of the Secretary that the date of February 10 be set as the deadline for submitting titles of papers to Section Vice-Presidents and that March 10 be set as the deadline for section programs to reach the Secretary.

Motion No. 66. Motion by Dr. White, seconded by Father Twellmeyer, that February 10 be set as the deadline for submitting titles to Section Vice-Presidents and that Section Vice-Presidents be notified of this action immediately and that the membership be so advised after the Christmas holidays. After a brief discussion of the amount of time required to solicit titles from members of sections and to compile section programs, the motion passed unanimously.

Report from Medical Sciences Section, by Dr. Hanson.

> Our approach to "new membership appeal" is purposefully being delayed. Last year our membership increased greatly and its effect would probably be felt this year. Therefore, with the call for papers we hope the impetus of the annual meeting being held in Mobile may be a new incentive. We feel it could help us acquire some individuals who have previously declined these opportunities. Since renewal is customary, new membership is most important.

Motion No. 67. Motion by Dr. Carr, seconded by Dr. Feazel, that the report of the Medical Sciences Section be accepted. Motion passed unanimously.

Report of the Science Education Section by Mrs. Ward for Vice-President Kuderna.

Values of the Junior Academy of Science.

> Part 1. Three past presidents of the Junior Academy of Science are presently attending Spring Hill College. They are:
>
> Marvin Uphouse—President 1957-58
> Theresa Hagendorfer—President 1958-59
> Eric Revere—President 1959-60
>
> They will speak on the values they have received from the AJAS and related experiences.
>
> Teresa attended the National Science Fair in California. Eric attended

the first Science Student Institute in Massachusetts, sponsored by the National Science Foundation.

Part 2. Science Projects.

A teacher from the Mobile region will discuss the recent division of Junior and Senior High science projects display.

This part of the program is incomplete as of this date.

Motion No. 68. Motion by Dr. McCullough, seconded by Father Twellmeyer, that the report of the Science Education Section be accepted. There followed a discussion of the perennial problem of arranging time for the section's program that would in no way conflict with the time its members must be in attendance at the Junior Academy of Science exhibits. It was recommended that the Academy Secretary and the Chairman of Section VII work out this conflict, after which the motion passed unanimously.

The President called for items of Old Business.

The application for membership form to be revised by the Admissions to Membership Committee was discussed by the Secretary. Minor changes seemed advisable to improve its value in the records of the Academy. Since any revisions would require that the form be reprinted and since the Finance Committee may recommend at the Spring Executive Meeting a change in membership dues, revision of the form was postponed until the next meeting of the Executive Committee.

The President recessed the meeting at 12:00 noon.

The meeting was reconvened at 12:45 p.m.

The Secretary asked for guidance in preparing the program for the 1961 Annual Meeting. The Committee favored reserving Thursday night, April 6, for the Spring Meeting of the Executive Committee. The majority agreed that one general session would be adequate and that it should be the Business Meeting of the Academy. It will be held on Friday afternoon following section meetings and will begin at 4 p.m. Friday night is to be reserved for the joint banquet of the Academy and the Junior Academy. Vice-Presidents of sections may schedule formal programs on Saturday morning. Other details for timing of the annual meeting were left to the Chairman of Local Arrangements and the President of the Academy.

The President called for items of New Business.

Dr. Patton suggested that the Academy shuold express positive interest in teacher certification. He summarized activities at national, regional, and state levels as set forth in his report which follows as a part of these minutes.

THE SITUATION: NATIONALLY (*AIBS Bulletin*, October 1960). "For the first time in a number of years—scientists of the country have

an opportunity to influence the policies being established for the certification of teachers in the secondary schools . . . With a grant from the Carnegie Foundation and the AAAS and . . . National Association of State Directors of Teacher Education and Certification are during the present year conducting a study of the certification of secondary teachers of science and mathematics . . . The plan is to collect . . suggestions regarding certification policy and practice for a report . . . to the NASDTEC meeting in June of 1961 when final results and recommendations will be prepared."

Scientists' interest evinced nationally: 1. Biological Sciences Curriculum study has a Teacher Preparation Committee studying certification of teachers of science and mathematics; 2. A Cooperative Committee of the AAAS has issued a report of recommendations on certification (*American Biology Teacher*, February 1960, and *Science*, April 1960).

REGIONALLY (same *AIBS Bulletin*). Up to 50 scientists, educators, and public school administrators met by invitation for two days in April 1960 at Atlanta, and recommendations were probably sent to the NASDTEC meeting of June 1960. Was Alabama or its Academy of Science represented in Atlanta?

IN ALABAMA. "It is hoped that in each state there will be meetings on the problem during the fall and winter of 1960-61 . . . In Iowa, with the blessing of the director of certification, the Iowa Academy of Science is conducting the state meetings as part of its 1960-61 program. Already existing committees on Science Teaching and certification have been given the responsibility for conducting the study. Plans are for four meetings in the state during the fall to which representation from each of the colleges and junior colleges within the state will be invited . . . Suggestions and recommendations will be completed for a report to the academy meeting next spring. If accepted by the Academy, these will be forwarded to the state certification officer. He has expressed pleasure that the science organization is willing to provide the recommendations. He already has such a statement from the English teachers and finds it very useful with colleges who want to let students by with less than desirable training." (same *AIBS Bulletin*).

Is such a study under way in Alabama?

Mr. Goetz, President of the Academy, feels that the Academy could and should be of service in certification.

Dr. J. C. Blair, Director of the Division of Secondary Education in the Alabama Department of Education, is very much interested.

Mr. Heustess of the State Department of Education has asked me to transmit an invitation for the Academy to present recommendations to a meeting of the Alabama Council on Teacher Education in Spring 1961.

Other background?

A PROPOSAL: GENERAL. That the Academy take advantage of this opportunity to begin, and persist in, presenting well-considered recommendations to public-school authorities; and to co-operate actively in other ways with the Alabama Department of Education for improvement of teaching of science and mathematics.

SPECIFIC. 1. That the Academy establish with the State Department of Education a joint committee of long-tenure members who will transmit, consider, recommend, and follow up matters of mutual concern in the field of science education. 2. That the Academy either (a) obtain from its membership recommendations on the AAAS certification report for presentation to the 1961 ACTE meeting, or (b) participate in a preliminary discussion at the 1961 ACTE meeting with the understanding that specific recommendations from the Academy will be transmitted later.

Motion No. 69. Motion by Dr. Hansen, seconded by DeJarnette, that the Academy take part in deliberations relative to teacher certification if extended an invitation and that the President immediately appoint representatives from the Academy to take part in any meetings called to discuss this topic. Motion passed unanimously.

President Goetz appointed Patton and Wheeler to represent the Academy at meetings dealing with teacher certification.

The Academy's Editor of the Journal, Dr. Hansen, requested that he be replaced in 1961 and that the balance of the three-year term be filled by appointment by the president. The Committee was receptive to the move based on reasons and explanations given by the Editor. The Secretary asked for guidance in handling complimentary memberships when they expire. Several proposals were suggested. The Executive Committee favored extending an invitation to each to become individual members of the Academy.

The Secretary was instructed to notify each person when his complimentary membership expires and to extend the invitation to become a member in another category and to express the appreciation of the Academy for services rendered while serving as a complimntary member.

Motion No. 70. Motion by Dr. McCullough, seconded by Dr. Boozer, that the meeting be adjourned. Motion passed unanimously.

The meeting was adjourned at 1:30 p.m.

W. B. DeVall, Secretary

SPRING EXECUTIVE COMMITTEE MEETING

Spring Hill College, Mobile, April 6, 1961

The meeting was called to order at 8:00 p.m. by James R. Goetz President, with thirty persons in attendance.

The following members of the Executive Committee were in attendance and were introduced by the Secretary: Paul C. Bailey, Samuel B. Barker, William J. Barrett, Reuben B. Boozer, Clyde H. Cantrell, E. D. Chastain, Jr., T. W. Daniel, Jr., David L. DeJarnette, W. B. DeVall, James F. Doster, Lowell M. Duffey, Louis J. Eisele, S. J., Charles E. Feazel, James R. Goetz, Clarence C. Hall, Jr., A. T. Hansen, Roger W. Hanson, A. F. Hemphill, William D. Ivey, Jerome Kuderna, E. Carl Sensenig, George O. Twellmeyer, S. J., R. E. Wheeler.

Guests present were Otis M. Clark, Jr., Halbert R. Gamble, Oscar L. Hurtt, Miss Clustie McTyeire, H. S. Strickland, Carlton Whitt, and Joseph H. Yeager.

The Secretary was asked to read the minutes of the December 3, 1960 Executive Committee Meeting.

Motion No. 71. Motion by Dr. Barker, seconded by Dr. Hanson, that the minutes of the December 3, 1960 meeting be approved with the following revisions: "That Motion No. 60 be corrected to read 'page 49, No. 2 and page 50, No. 3e' instead of 'pages 22-23' and 'that the second and third sentences of the second paragraph on page 10 be deleted'." Motion passed unanimously.

Report of the Committee on Local Arrangements by Dr. Hemphill.

> Arrangements for the Academy and Junior Academy have been completed. All sections will meet in the rooms designated in the program. Each room is identified with a sign giving the name of the Section. Directions to meeting rooms and buildings in which other activities are scheduled will appear on signs posted at major intersections of driveways and walkways on the campus.

Report of the Editor of the Newsletter prepared by Mrs. Carol Ann Padgett and by the Secretary.

> 1. COST: The Newsletter costs approximately $25.00 to edit and publish. This is variable according to the size of the Newsletter. Items included in this cost are typing expenses, paper and lithograph stencils. The 1961 A.A.S. Budget includes $75.00 to cover Newsletter expenses and this amount is ample for three issues a year.
>
> 2. RESPONSE TO REQUESTS FOR NEWS: The response for the three issues thus far published by the present editor has been very good. Cards and letters are sent out by the editor to about 50 key people and news bureaus over the state requesting news items about one month before each Newsletter deadline. Special appreciation is to be conveyed

to these people who have so readily and regularly contributed news. Without this generous cooperation the Newsletter would not materialize.
3. FUTURE OF THE NEWSLETTER: Although publishing the Newsletter is a time consuming job, the present editor is willing to continue assuming this responsibility as long as it is feasible and as long as the Academy deems necessary. Since contributions of news have been steadily flowing, it may be possible to issue four editions instead of three in the future.

Motion No. 72. Motion by Dr. Barker, seconded by Mr. Boozer, that the report of the Editor of the Newsletter be accepted and that Mrs. Padgett be commended for the fine work done during the past year. Discussion on the motion brought out the possibility that the President and President-Elect could use the Newsletter as a medium through which to maintain contact with the membership. Motion passed unanimously.

Report from the Permanent Counselor of the Alabama Junior Academy of Science by Dr. Wheeler.

On November 5, 1960, the executive committee of the Alabama Junior Academy of Science met at Mobile, Alabama. A budget was adopted and plans were made for the annual convention to be held (April 7 and 8) concurrently with the Senior Academy on the Spring Hill campus.

During the year, routine procedures were followed with special efforts being made to enlist new chapters. Charters will be granted to 22 new members, and 3 old members have asked to be re-instated.

The progress of the work of the Alabama Junior Academy of Science will be summarized by regions.

NORTH ALABAMA REGION: Miss Ibbie Bradford, Florence State College, Counselor
Senior High Members: 10 schools
Junior High Members: 0

NORTHEASTERN REGION: Dr. Harold Strickland, Jacksonville State College, Counselor
Senior High Members: 26 schools
Junior High Members: 17 schools

NORTH CENTRAL REGION: Miss Clustie McTyeire, Hueytown High, Counselor.
Senior High Members: 16 schools
Junior High Members: 0

MOBILE REGION: Mrs. Lucile Lloyd, Fairview, Alabama, Counselor.
Senior High Members: 20 schools
Junior High Members: 5 schools

SOUTHEASTERN REGION: Professor G. O. Spencer, Troy State College Counselor.
Senior High Members: 15 schools
Junior High Members: 0 schools

Number of Senior High School Papers at the Regional Meeting:

North Alabama Region:	28	Mobile Region:	7
Northeastern Region:	6	Southeastern Region:	8
North Central Region:	6		

Number of Junior High School Papers at Regional meetings:

North Alabama Region:	0	Mobile Region:	0
North Central Region:	0	Southeastern Region:	10
Northeastern Region:	5		

Professor D. F. Butler, Associate Counselor No. 1, Troy State College.

Professor Reuben Boozer, Associate Counselor No. 2, Jacksonville State College.

Dr. R. E. Wheeler, Permanent Counselor, Howard College.

SCIENCE LECTURE PROGRAM

The Alabama Junior Academy of Science plans to sponsor an extended lecture program in mathematics, engineering, and all fields of science during the school year 1961-62. Our goal is to have at least one lecture on some field of science at every high school in the state.

An attempt will be made to obtain a National Science Foundation Grant to pay the traveling expenses of the visiting lecturers. However, the announcement of awards will not be made until February, 1962, and in order for the program to be effective it should be inaugurated at the beginning of the school year. Thus it will be necessary to start the program on a voluntary basis.

Motion No. 73. Motion by Father Twellmeyer, seconded by Dr. Cantrell, that the Report of the Permanent Counselor for the A.J. A. S. be accepted, that Mr. Strickland and Mr. Boozer be commended for their activities, and that the officers of the Alabama Academy of Science publicize the Science Lecture Program, seek participants, and distribute the form prepared by the counselor to all interested persons. Motion passed unanimously.

Report of Co-Ordinator of Science Fairs by Father Twellmeyer.

1. The five regional science fairs were held on the weekend of March 23-25, 1961. Each region selected two finalists to be sent to the National Science Fair in Kansas City to be held May 10-13, 1961. These finalists have been certified to Science Service by each region. Hotel and plane reservations have been made for them. Chaperones have been designated to accompany the finalists on their trip.

The finalists and their chaperones are:

Central Region: Finalists: George Hamner, Tuscaloosa High School; Joan Palmer, John Carroll High School, Birmingham.

Mobile Region: Finalists: James McAleer, McGill Institute, Mobile; Melinda McGill, Marietta Johnson School of Organic Education, Fairhope.

North Region: Finalists: Hugh W. Greene, Morgan County High School, Hartselle; Marilyn White, Athens High School, Athens.

Northeastern Region: Finalists: Omer Lee Burnett, Sylacauga High School, Sylacauga; Joe Upchurch, Talladega High School, Talladega.

Southeastern Region: Finalists: Billy Bishop, A. G. Parish High; Catherine Kampe, A. G. Parish High.

Chaperone for boys: Mr. Reuben Boozer of the Northeastern Region.

Chaperone for girls: Mrs. G. G. Countryman of Southeastern Region.

2. The date set by the Committee on Regional Science Fairs for holding the 1962 fairs is the weekend of March 22-24. This does not conflict with the A.E.A. meeting which is to be held on the previous weekend.

3. The following territorial changes in the science fair regions have been confirmed by the Committee on Regional Science Fairs:

That part of Blount County that was in the North Region has been transferred to the Central Region. The parts of Chambers and Tallapoosa Counties that were in the Central Region have been transferred to the Southeastern Region. Jackson and Marshall counties have been transferred from the North Region to the Northeastern Region.

4. The Committee on Regional Science Fairs has adopted a poster announcing the five regional science fairs in Alabama to be used by each of the regional fairs for distribution to the schools.

5. Four Regions have completed arrangements for tax-exempt status. Arrangements of the North Region are in process.

6. A questionnaire sent to the school of the Mobile Region elicited the following interesting information that gives some indication of the influence of the regional fair movement in Alabama.

5474 exhibits were made in 31 schools; of these, 4828 were individual projects and 646 were group projects.

Approximately 30,000 people viewed the projects in the 30 preliminary school fairs.

An estimated 5,000 people viewed the projects in the Regional Fair.

Motion No. 74. Motion by Dr. Barker, seconded by Dr. Cantrell that the report of the Co-ordinator of Science Fairs be accepted. Motion passed unanimously.

The Executive Committee commended the Co-Ordinator of Science Fairs and his associates for the leadership that has led to stimulation of interest in science fair activity.

Report of the Admissions to Membership Committee by Secretary DeVall.

The Academy adopted the calendar year, at its 1960 annual meeting, as the basis to dues payment. It is the recommendation of the Secretary, who serves as chairman of this committee, that all membership data be compiled on a calendar year basis also.

The membership record for the calendar year 1960 is as follows:

New members approved	32
Membership loss:	
Resigned	20

Dropped, non-payment of dues	2
Deceased	3
Address unknown, dues unpaid	6
Total:	31
Net gain	51
Total membership 12-31-60	577
Applications received since January 1, 1961	22

It is regrettable that during 1960, three industrial memberships were lost and one sustaining membership was terminated.

Incorporated as part of this report is the recommendation that the Vice-Presidents and Vice-Chairmen of Sections I, III, and IX be commended for their membership activity. These sections were responsible for adding 18, 27, and 24 members respectively.

Your chairman sincerely appreciates the assistance of Father Patrick H. Yancy and Dr. Paul C. Bailey for their assistance in processing applications for membership as members of the committee.

Motion No. 75. Motion by Dr. Hansen, seconded by Dr. Bailey, that the report of the Admissions to Membership Committee be accepted. Motion passed unanimously.

Report of the Treasurer by Dr. Barrett.

BALANCE, January 1, 1960			$2,771.71
RECEIPTS:			
Membership Dues (including part of 1961 dues)		$2,529.00	
Gifts		280.00	
Annual Meeting		1,167.18	
Sale of Journals		12.00	
Interest on Savings Account		49.19	
		4,037.37	4,037.37
Total			$6,809.08
EXPENDITURES:			
Publication of Journal		573.00	
Assistance to Junior Academy		450.94	
Student Research Awards		90.00	
Research Grants		625.00	
Academy Conference Assessment		9.90	
Annual Meeting		1,459.59	
Operating Expense			
Office of President	$104.95		
Office of Secretary and Treasurer	378.33		
Office of Editor of Journal	81.01		
Office of Permanent Counselor to Junior Academy	51.76		
Newsletter	59.01		
Purchase of Filing Cabinets	175.92		
	850.98	850.98	
Total		4,059.41	4,059.41

BALANCE, December 31, 1960	1,549.19
Savings Account	1,549.19
Checking Account	1,200.48
Total	$2,749.67

Because of a change in the fiscal year of the Academy to coincide with the calendar year, the period covered by the report (1960) overlaps the period of the last previous annual report (March 14, 1959, to April 2, 1960). The amount received as membership dues includes 1959-1960 dues and a part of the dues for the 1961 fiscal year.

Motion No. 76. Motion by Dr. Bailey, seconded by Dr. Wheeler, that the report of the Treasurer be accepted. During the discussion it was pointed out that expenditures exceeded receipts for the period reported in the amount of $22.04. Motion passed unanimously.

Report of the Membership Committee by Dr. Bailey.

Section Vice-Chairmen were encouraged to solicit memberships for their respective section. Letters prepared by the chairman were sent to the Section Vice-Chairmen along with Membership Application Forms. In addition letters pointing out the advantages of Academy membership were sent to selected individuals.

Report of the Research Committee by Dr. Sensenig.

During the period from April 1, 1960-April 1, 1961, two research grants have been approved and activated:

1. To J. Allen Tower, Professor of Geography, Birmingham-Southern College, in the amount of $200.00 to continue and complete his research program entitled "Agricultural Change in Alabama."
2. To Joe Allen Farmer, Graduate Student, Department of Biology, University of Alabama, in the amount of $200.00 to assist him to complete his research in studies for the Ph.D. degree on "Ecology of *Croton Alabamensis*."

Mr. Farmer had previously received a grant from this Committee but it was considered that his second application was worthy of continuation.

Due to the failure of Dr. S. W. Ingram to activate a research grant approved in February, 1960, in the amount of $150.00 to support a project entitled, "The Isomerization of the 2-bromo-2-butenes" it was the decision of Dr. Barrett and myself that this fund should be returned to the research grant budget. In discussing this with Dr. Ingram, he does have an application to N.S.F. in the amount of $5,000.00. Dr. Ingram has been informed that if his N.S.F. grant is not approved, he has the privilege of re-applying to this committee for research funds.

Motion No. 77. Motion by Dr. Barker, seconded by Dr. Hanson, that the report of the Research Committee be accepted. After a discussion regarding availability of funds from the American Academy for Advancement of Science and the amount available for grants

from the Alabama Academy of Science, the motion passed unanimously.

Report of the Finance Committee by President Goetz in the absence of Chairman White.

At the meeting of the Executive Committee on December 3, 1960, the Finance Committee was directed to study potential sources of income. The committee recommends that the dues for individual members should be raised to $5.00. So long as the dues remain at their current $3.00 level, the Academy can hardly claim, when approaching companies and foundations for assistance, that its members are realistically facing the Academy's financial problems. Beyond that, the campaign for more individual members is essential, but the higher individual dues ought to make it easier to approach companies and foundations.

Some personal recommendations are:

1. We ought to spend the Academy's money and keep its records in such a way that we can honestly say when soliciting help from outside organizations, "We support our own business by our own dues. We ask your help only for the Junior Academy program." I believe, in other words, that the Junior Academy program has much more appeal to outsiders than the Senior Academy's, and that we ought to take full advantage of the Junior Academy appeal.
2. We ought to stop speaking of company memberships, and instead call company dues what they are—contributions. I believe we would get a more favorable reception for contributions limited to the Junior Academy program than for dues to the whole organization.
3. We ought to try to minimize the multiplicity of requests for financial aid to programs to interest students in science. Specifically, I doubt that many companies care enough to try to evaluate separately the claims of science fairs, the Academy, and the Gorgas Foundation. I think that these groups ought to study the desirability of a pooled solicitation, somewhat like the community chest.

Motion No. 78. Motion by Dr. Barrett, seconded by Father Twellmeyer, that the Report of the Finance Committee and its recommendations be accepted. Discussion followed during which it was brought out that Dr. Locke White would be leaving the state within a few months and therefore would not be able to work toward implementation or recommendations contained in his report. Father Twellmeyer endorsed solicitation of funds for the Alabama Junior Academy of Science. He stated that the science fairs are independent of the A.A.S. from the standpoint of financing. He suggested that the financial structure of the Gorgas Program be maintained. Dr. Barker pointed out the danger of soliciting funds through the A.A.S. when the Science Fair Program is already financially successful. He stated that the annual dues paid by individual members in his opinion were too low. Motion passed unanimously.

Motion No. 79. Motion by Father Twellmeyer, seconded by Dr. Barker, that because of the need to meet the financial obligations of the Academy, Article 2 of the Bylaws be amended by changing the amount paid as dues by individual members from $3.00 per annum to $5.00 per annum and that the Academy membership be given an opportunity to register its endorsement of this action at the business meeting to be held April 7. During the discussion the concensus of the committee was that if the motion passed, a complete explanation of the action be carried in the next issue of the Newsletter for the benefit of the Academy membership. The motion passed by unanimous vote in accordance with Article 9 of the Bylaws.

The President recessed the meeting at 9:40 p.m.

The meeting was reconvened at 9:50 p.m.

President Goetz read a telegram received from Gibbs Patton relative to the action taken by the Executive Committee on December 3, 1960. The action recommended in Motion 69 relative to teacher certification is reported as follows:

> Pursuant to president's instructions of Autumn, 1961, Wheeler and Patton as academy committee on science teacher certification corresponded in winter with Dr. Morrison McCall of State Department of Education whose cordial response referred to invitation to spring conference with Alabama Council of Teachers Education. Invitation not received to date. Correspondence also begun with A.A.A.S. on current national study of teacher education.
>
> Request that academy adopt in spring, 1962, specific recommendations on teacher training in each science and in mathematics based on current national study. Does new president wish to appoint section representative to a committee to formulate such recommendation?

Motion No. 80. Motion by Mr. Boozer, seconded by Dr. Hansen, that the report of the Special Teachers Certification Committee read by the President be accepted. Motion passed unanimously.

Report of the Audit Committee by the President in the absence of the chairman.

> "We the undersigned Audit Committee have examined the financial records of the Alabama Academy of Science and have found them to be true and accurate."

Motion No. 81. Motion by Dr. Barker, seconded by Father Eisele, that the report of the Audit Committee be accepted. Motion passed unanimously.

The President reported that the 1962 Annual Meeting of the Academy would be held at Troy State College. Several members of the committee pointed out the need to avoid conflicts in meeting

dates between the Alabama Education Association, Science Fairs, and Regional and National Scientific meetings.

Motion No. 82. Motion by Dr. Barker, seconded by Mr. Boozer, that the immediate past President and the President be empowered to set the dates for the 1962 Annual Meeting and announce these dates after consultation with representative from Troy State College. Motion passed unanimously.

Report of the Editor of the Journal called for by the President. Dr. Hansen, Editor, stated that his report would be presented at the Business Meeting of the Academy.

Report of the Archivist by the Secretary.

"There has been little change in the work and activities of the Archivist since the last annual meeting.

During the year plans were worked out whereby the Archivist no longer keeps a record of members of the Academy. Since the Secretary's records are supposed to be accurate, and particularly since he has all members on addressograph plates, it is convenient to send the envelopes for mailing the *Journal* to the Secretary's office, where they are addressographed and returned to the Archivist for stuffing and mailing. This plan has proved successful because scarcely any members complain now of nonreceipt of the *Journal*.

Approximately 135 issues of the *Journal* are mailed on exchange account. With the printing of 800 or 900 copies of each issue there is a residue which may be used for further exchanges. An effort is being made to expand the exchange list in order to have the *Journal* more widely available throughout the world and in order to receive more titles on an exchange basis.

Most of the records of the Academy are now in good order and available for consultation and reference of the members. During the year President Goetz authorized the purchase of two vertical files in which correspondence, reports, etc. may be kept on permanent file. The office of the Archivist is grateful to the President, all officers, and members of the Academy for advice and counsel at any time."

Motion No. 83. Motion by Father Eisele, seconded by Dr. Wheeler, that the report of the Archivist be accepted. During the discussion it was brought out that the public library in Birmingham did not have a complete file of the Journal of the Academy. President Goetz reported, however, that all missing issues were either supplied by the Archivist or had been microfilmed and that the library file is now complete. Motion passed unanimously.

Report of the Long-Range Planning Committee by Dr. Barker in behalf of Dr. Fincher, Chairman.

The Long-Range Planning Committee consists of two members since Dr. Locke White became chairman of another committee. The Commit-

tee was disposed to give consideration to two kinds of long-range planning. One is relatively short-ranged, which is brought to mind by the immediate financial needs of the Academy. On this point it is apparent that the Academy is in need of additional funds to operate at its present level. Inasmuch as the committees have suggested certain projects that would stimulate interest in the Academy of Science, in the Junior Academy of Science, in the science fairs and in promoting science careers among high school students, it would be readily apparent that still more funds are needed.

1. FINANCE. Since there is a special committee studying financing, the Long-Range Planning Committee will merely recommend that the Academy of Science face its financial situation realistically and try to establish a new scale of dues that would cover the large part of the cost of operation of the Academy. It is noted that there are very few organizations, especially in Science, that have membership dues as low as three dollars per year, and most of them are twice that amount.

The Committee also feels that a little more of a financial investment by the members might create more interest in the affairs of the Academy of Science.

2. INTERESTING MEETINGS. Previous official discussions have indicated a point of concern over the attendance at the Academy meetings, and have pointed to the fact that it is difficult to persuade members to come and stay throughout the entire sessions. At this point the Long-Range Planning Committee is of the opinion that more attention should be given to the enrichment of the program for the annual meeting. It is still anticipated that the Academy could schedule two full days of program, if early in the sessions there were scheduled a stimulating and captivating speaker or a symposium on the subject of interest to Alabama in general, and if an outside lecturer of note could be brought to speak late in the program of the second day. The latter is one of the ideas that should probably carry a small honorarium that would be attractive to the speakers of international reputation who would have a particular message in some phase of science. The Committee then recommends that the program be further enriched by bringing in, if possible, an outside lecturer who is a specialist on some branch of science and who would be especially stimulating to the youth.

While field trips and the like have always been considered as a part of the Academy program, the Committee believes that there is still a possibility of planning them to combine pleasure and educational trips by boat or by caravan to particular points of interest that naturally fit into the theme of the annual Academy program. It seems possible that for one of the trips there might be scheduled one of the special lectures mentioned above.

The Long-Range Planning Committee recommends further that special consideration be given to field trips that would mix social and educational experiences and which might induce the constituency to stay for the entire program. The fellowship which has always been an important part of the meetings cannot be found when time is lacking.

3. SCIENCE EDUCATION. While there was an effort in the immediately preceding years to generate interest in science careers by an ambitious lecture-demonstration project that could be taken by various members to high school classrooms, or that could be loaned to the schools for demonstration purposes, it is the opinion of this Committee that should the entire membership of the Academy be challenged by any particular project, this one included, there would be more general interest in Academy affairs which interest would incidentally spill over into participation in the annual meetings. The Committee points with justifiable pride to the relationship that has existed between the Senior Academy and the Junior Academy, especially those that have brought them together for the annual dinner.

This closer collaboration has been partially brought about by selecting the delegates who would attend the Junior Academy annual meeting, making possible a wide representation of the science clubs and exhibits, with the smallest possible burden on the host institution. The close-working relationship of the Academy and the Science Fair is also commendable and should be continued with all possible enthusiasm.

There seems to remain a further need for accentuating the matter of science education. Previous efforts on the part of the Academy of Science and the State Department of Education have been friutful especially in the matter of recommendations concerning high school teaching equipment for laboratory purposes.

It is hoped that in the future there will be a conference on the advantages of increasing subject matter content in the curriculum for prospective teachers of science. This Committee, therefore, recommends that continued effort be made on the part of the officials of the Academy and interested persons in the State Department of Education, including Dr. J. C. Blair, and if possible, further improving the preparation and stimulation of prospective teachers in mathematics and the sciences.

4. NATURAL HISTORY MUSEUM. Since the 1946 meeting of the Academy in which the Long-Range Planning Committee mentioned the need for a Natural History Museum in the state there have been many discussions of this subject.

In the fifteen years that have lapsed the City of Birmingham has provided in Lane Park a zoo, or zoological garden, and the City Commission has just recently approved the establishment of botanical gardens in the same park. The increased interest in natural history in this area has again brought into focus the need of a natural history museum.

Some of the members of the Academy might be interested in working on a committee to discuss the matter with the proper officials at the proper time.

Attention should be given to the functions that Academy members consider to be inherent in a natural history museum strategically located in the state as well as to the plans for construction and designs for future development. In the light of interest in this particular project when the occasion arises, the Long-Range Planning Committee recommends that the Academy of Science go on record endorsing any efforts that might be forthcoming in the direction of establishing a natural history museum and that the president be empowered to appoint a

committee of interested persons who might be available as consultants, or as research and resource personnel in the event such a development is imminent.

Motion No. 84. Motion by Mr. Boozer, seconded by Dr. Barrett, that the report of the Long-Range Planning Committee be accepted. Motion passed unanimously.

Report of the Co-Ordinator with Science Clubs of America by the Secretary.

To keep the Science Talent Search activated, the Co-operator fill out a form mailed to him by the Science Clubs of America and signs as the Academy representative, annually.

Lists of interested high school and junior high school science teachers are prepared and mailed to SCA each year.

Science sponsors of affiliated clubs must re-affiliate their clubs each year by completing a form mailed to them by SCA. Should they fail to complete the form, their name is removed from the roster. This year 477 teachers of white and Negro high schools of Alabama have affiliated their clubs with SCA.

It might be well to point out that an activated science club does not always exist in each school that is affiliated with SCA. However, it is from this humble beginning that science clubs eventually develop. Furthermore, these affiliated clubs not only receive helpful material on the development and promotion of science clubs, but also receive information on the development of science projects and the organization of local and regional science fairs as well.

If the regional science club counsellors would like a list of affiliated clubs in their region, this list could be compiled for them.

Motion No. 85. Motion by Dr. Bailey, seconded by Dr. Hanson, that the report of the Co-ordinator with Science Clubs of America be accepted. Motion passed unanimously.

Report of Science Education Committee by the Secretary in the absence of Frances D. Jones, Chairman.

"The Science Education Committee did not meet during the current year. The Chairman, in line with her work, has sent out to science teachers information concerning science fairs, Alabama Academy activities, experimental science classes and National Science Foundation Institutes.

The chairman was privileged to represent Alabama at a Feasibility Conference in Washington, D. C., which dealt with improving the science program in elementary and junior high schools. No final report of this conference is available at this time.

A sub-committee on Certification of Science Teachers was appointed at the December Executive Board meeting with Dr. Gibbes Patton as chairman. He may have a report of this committee."

The president called for items of Old Business.

Dr. Barker presented to the President the final draft of the

"History of the Alabama Academy of Science." He then read a report of the Ad Hoc Committee appointed to complete the revision of the manuscript.

> At the Executive Committee meeting in Montgomery a year ago, Drs. Paul Bailey and Sam Barker were authorized to edit the manuscripts comprising a History of the Alabama Academy of Science, collected under the guidance of Clyde H. Cantrell, Archivist of the Academy. We have proceeded with this and herewith present to the Executive Committee a completed, thorough revision of the original material turned over to us by Dr. Cantrell, extended to 1960. Each chapter has been submitted to its original creator and has been approved by him. We wish to commend the unselfishness of these men in relinquishing, for the most part, the traditional petty sensitivities of authors in order to expedite the common achievement.
>
> After many discussions of the best method of publication of this History, the Executive Committee last year also approved the procedure of issuing it as a Supplement to the Academy's *Journal*. Because of the tremendous investment in personal time on the part of many people, we feel that immediate publication is imperative and urge utilization of the mechanism of a supplement.

Motion No. 86. Motion by Dr. Barker, seconded by Father Eisele, that the manuscript titled "History of the Alabama Academy of Science" be published as a supplement to the Journal of the Academy, that copies be distributed to all entitled to the publications of the Academy, and that its publication be financed by Auburn University and the Academy by sharing the cost equally if possible. Motion passed unanimously.

The Secretary asked for instructions relative to printing of a new Membership Application Form. He was instructed to lithograph a one-year supply after incorporating the revisions recommended by the Admissions to Membership Committee.

Motion No. 87. Motion by Dr. Barker, seconded by Dr. Hansen, that the immediate past President be authorized to proceed with a revision of the Academy's printed brochure and that revisions be made in accordance with the joint recommendations of the Finance and Membership Committees and further that after consultation with the Treasurer, he recommended the format for a revised brochure at the fall meeting of the Executive Committee in 1961. During the discussion it was brought out that the present supply is limited, that it can be used effectively by the Membership Committee and that the cost of reprinting will warrant consideration by the Finance Committee. Motion passed unanimously.

The President called for items of New Business.

President Goetz announced that Dr. C. C. Hall, Jr., Howard Col-

lege, Birmingham, Alabama, will serve as the Editor of the Journal beginning in 1961. He succeeds Dr. A. T. Hansen.

Mr. Boozer suggested that a study be made of the relationships between the Alabama Junior Academy of Science and Science Fairs. It was pointed out that under the present system, exhibits by the Alabama Junior Academy of Science are secondary after exhibits entered in Science Fairs have been judged. The ultimate solution may lie in selecting the first place winner in each division (both boy and girl) from each Science Fair Region. The solution may come from a joint recommendation of the Permanent Counselor of the Alabama Junior Academy of Science and the Co-ordinator of Science Fairs.

The Secretary recommended that the President consider holding the Fall Executive Meeting prior to Thanksgiving. He recommended that plans for the Annual Meeting be worked out with the host institution prior to the Fall Executive Meeting and that all arrangements be discussed. Section Vice-Presidents could then be notified immediately to plan programs to fit an approved time schedule. He further recommended that Section Vice-Presidents submit their Section Programs to the Secretary each year by February 15.

The Secretary pointed out that several amendments to the Bylaws have been approved but that the executive committee members do not have a revised copy. He recommended that a special committee be appointed by the President to draft a revised set of Bylaws and if possible give consideration to a revision of their format so that Sections and Articles can be properly identified.

Motion No. 88. Motion by Father Eisele, seconded by Dr. Barker, that the meeting be adjourned. Motion passed unanimously.

The meeting was adjourned at 11:15 p.m.

W. B. DeVall, Secretary

ANNUAL BUSINESS MEETING

Spring Hill College, Mobile, April 7, 1961

The meeting was called to order by President Goetz at 4:30 p.m.

The minutes of the business meeting held at Huntingdon College on April 2, 1960, were read by the Secretary.

Motion No. 89. Motion by Dr. Barker, seconded by Dr. Hansen, that the minutes be approved as read. Motion passed unanimously.

Report of the Secretary by Dr. DeVall.

The secretary has carried out the instructions of the Executive Com-

mittee and has served as a central mailing office for the Journal and Newsletter. Dues statements have been mailed by the treasurer.

All section vice-presidents were provided with a list of section members following the fall meeting of the Executive Committee.

Certain problems develop each year when compiling the program for the Annual Meeting. Some of these could be eliminated if the fall meeting of the Executive Committee were held prior to the Thanksgiving-Christmas holiday period. This would enable the secretary to send out notices of the dates set for papers, etc. prior to the holiday mail rush. It is recommended that section programs be in the hands of the secretary not later than February 15, if an annual meeting is to be held toward the end of March or the first part of April.

Your secretary took part in the Regional Science Fair for the Southeast region. He served as chairman of judges for the three classifications in the Junior Division. The fair, held in Montgomery, was an outstanding display of initiative by boys and girls. More than 250 exhibits were judged in the Junior Division.

Thirty-four different colleges, agencies, businesses and organizations are represented at the 1961 meeting.

Registration at this, the 38th Annual Meeting, totaled 135. By sections the totals were:

I	Biological Sciences	31
II	Chemistry	12
III	Geology and Anthropology	14
IV	Forestry, Geography and Conservation	4
V	Physics and Mathematics	13
VI	Industry and Economics	1
VII	Science Education	6
VIII	Social Sciences	9
IX	Medical Sciences	6
	Non-Member	24
	Miscellaneous	15
	Total	135

Motion No. 90. Motion by Dr. Barker, seconded by Dr. Steele, that the report of the Secretary be accepted. The schedule for the Fall Executive Meeting recommended by the Secretary was discussed. It was recommended that the President and the Secretary meet with representatives of the host institution and implement the recommendation if feasible. Motion passed unanimously.

Report of the Treasurer by Dr. Barrett in summary form.

Balance, January 1, 1960	$2771.71
Receipts	$4037.37
Expenditures	$4059.41
Balance, December 31, 1960	$2749.67

The report of the Treasurer was accepted by the President without opposition.

Report of the Editor of the Journal by Dr. Hansen.

"At the December, 1960, Executive Committee meeting the Editor reported that the *Journal* was behind schedule and expressed the hope that it might be current by April, 1961. His hopes have not been fulfilled, but there has been some progress. The July, 1960, issue is out. The printer has the copy for the October, 1960, number. Articles in hand, plus the membership list, will fill about a hundred pages—two undersize issues for January and April, 1961. The editor plans to prepare the remaining material in one operation and to get these two numbers out almost simultaneously. His target date is the brief break between the regular session and summer session.

The outstanding item of this report is that the Editor has felt impelled to terminate his editorship after one year. He intends to collaborate closely with his successor in order to facilitate the transition.

The President accepted the report without opposition.

Dr. C. C. Hall, incoming Editor of the Journal, was recognized and introduced to the membership.

The Report from the Finance Committee was brought before the membership by the President. Honoring the action of the Executive Committee regarding an increase in dues for Individual memberships, such action recorded in Motion 79, he stated that the Academy membership would be informed of the change in dues which will become effective January 1, 1962.

Motion No. 91. Motion by Dr. Barker, seconded by Father Eisele, that the annual dues of the Individual Membership category be increased from \$3.00 to \$5.00 effective with fiscal year 1962 and that the membership endorse the action of the Executive Committee. Motion passed unanimously.

Report of the Admissions to Membership Committee by the Secretary.

New members approved	82
Membership loss:	
Resigned	20
Dropped, non-payment of dues	2
Deceased	3
Address unknown, dues unpaid	6
Total:	31
Net gain:	51
Total membership 12-31-60	577
Applications received since January 1, 1961	22

There being no opposition the President accepted the report.

Several members felt that an effort should be made to identify all persons who have been granted Honorary Membership. It was

further suggested that such persons be identified on any list mimeographed or printed that shows the membership of the Alabama Academy of Science.

Report of the Audit Committee by Dr. Thomson.

> We the undersigned audit committee have examined the financial records of the Alabama Academy of Science and have found them to be true and accurate.

There being no opposition the President accepted the report as read.

Report of the Nominating Committee by Dr. Hanson.

> The Committee unanimously recommends the nomination of Father Louis J. Eisele, S. J., as President-Elect of the Academy.

After consultation with representatives of Troy State College, the President announced that the 1962 Annual Meeting would be held April 13-15 on the campus at Troy State College.

Report of the Resolutions Committee by Dr. McCullough.

> 1. Whereas the success of this, the 38th Annual Meeting of the Alabama Academy of Science has been enhanced and largely made possible by the hereinafter mentioned, therefore be it resolved:
>
> a) That the Academy express its appreciation for the hospitality of Spring Hill College and its president, the Very Reverend A. William Crandell.
>
> b) That the Academy recognizes and expresses its special appreciation for the excellent work of Dr. A. F. Hemphill and his associate members of the Local Arrangements Committee.
>
> c) That continuing gratitude be expressed for the hospitality of the Birmingham Division of the E. H. Sargent and Company in furnishing the annual banquet.
>
> 2. Whereas, since the last annual meeting, several careers and loyal, valuable services to the Academy have been terminated by death, now therefore be it resolved that the Academy extends its sympathy to the families of Dr. James O. Foley, J. D. Henry, and Walter Wing, and that copies of this resolution be sent to them and be spread upon the minutes of the Academy.

Motion No. 92. Motion by Dr. McCullough, seconded by Dr. Steele, that the report of the Resolutions Committee be accepted and that the Secretary send a letter and a copy of the resolutions to the families of deceased persons. Motion passed unanimously.

Motion No. 93. Motion by Dr. Wilkes, seconded by Dr. Cantrell, that the two persons approved for Honorary Membership at the 1960 Fall Meeting of the Executive Committee, Miss Winnie McGammery and Dr. Walter B. Jones, be recognized by the Academy. Motion not voted on.

There being no Old Business the President called for items of New Business.

Motion No. 94. Motion by Dr. Carr, seconded by Dr. Fincher, that the nominations for the office of President-Elect be closed and that Father Eisele be declared elected. Motion passed unanimously.

Motion No. 95. Motion by Dr. Barker, seconded by Dr. Hansen, that the nominations submitted by sections for section officers be accepted and that the nominees be declared elected subject to certification by the Secretary that each is a member of the Academy in good standing. Motion passed unanimously.

Motion No. 96. Motion by Dr. McCullough, seconded by Dr. Barker, that the two members of the Board of Trustees whose terms expired in 1961 be re-elected to serve a term of three years and that the Secretary notify each of their re-election. Motion passed unanimously.

Motion No. 97. Motion by majority of the membership in attendance and seconded by all present that the meeting be adjourned. The motion passed unanimously.

Meeting was adjourned at 5:10 p.m.

W. B. DeVall, Secretary

ALABAMA ACADEMY AWARD—1961

The Alabama Academy of Science made its annual presentation of The Academy's Award to Outstanding High School Science Teachers at the 38th annual meeting of the Academy in Mobile on April 7, 1961. Recipient of this year's award was Mrs. Reba C. Ponder of Ensley High School, Birmingham.

The Award is given annually to a high school science teacher for meritorious teaching of science. The Academy Award is one of the highest honors that is conferred upon a science teacher in Alabama. The purpose of the Award is to recognize those teachers who go beyond the classroom to stimulate scientific endeavor among their students. The Award consists of a citation* and a gold pin. This is the second time this Award has gone to a teacher at Ensley High School.

Mrs. Ponder was born in Marion, Alabama, and received her early education there. She is a graduate of Judson College and has done graduate work at George Washington University and Howard College.

Although Mrs. Ponder is not a Club Sponsor this year, her many

* Journal of The Alabama Academy of Science, *23*, 93 (1953).

years of devoted service and inspiring leadership of the Senior Electron Club of Ensley High School have earned this year's Award. Her students have earned high recognition with six Junior Academy First-Place Awards, five A.S.S.T.S. finalists, one Gorgas Scholarship recipient, and two four-year scholarships to Harvard.

Mrs. Ponder has one son who is a student in civil engineering at the University of Alabama. Her husband is Leon Ponder who is associated with a Birmingham roofing and heating company.

Dr. Emmett B. Carmichael, Assistant Dean, University of Alabama Medical Center, made the presentation at the joint banquet of the Senior and Junior Academies of Science.

GORGAS SCHOLARSHIP FOUNDATION

Report of the Scholarship Committee—1960-61

The annual Alabama State Science Talent Search completed its eighth year under the sponsorship of The Gorgas Scholarship Foundation, Inc. The winners from the white high schools were announced at the annual meeting of the Alabama Academy of Science on April 7 at Spring Hill College in Mobile. The winners from the Negro high schools were announced at Southern Research Institute on June 10, 1961.

Ninety-five seniors, representing twenty-nine white high schools (public and private) in the State of Alabama, completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Westinghouse Science Scholarships.

Of the students, ten were selected as finalists and invited to appear before a board of judges during the annual meeting of the Alabama Academy of Science at Spring Hill College, Mobile, Alabama, on Thursday, April 6, 1961. At that time they explained their science projects and were interviewed by each judge. The winners were announced at the annual banquet of the Alabama Junior Academy of Science by Dr. Emmett B. Carmichael, Chairman, The Gorgas Scholarship Foundation.

	Name	High School
1st Award	N. K. McCoy	Ramsay
2nd Award	G. L. Hamner	Tuscaloosa
3rd Award	M. E. Stells	John Carroll
4th Award	Miss Joan K. Palmer	John Carroll

1st Alternate	V. S. Grimes	Huntsville
2nd Alternate	W. E. McDermott	John Carroll
3rd Alternate	H. Miller	Shades Valley
4th Alternate	G. C. Morgan	Shades Valley
5th Alternate	L. C. Holmes	Foley
6th Alternate	D. A. Copeland	T. W. Martin

Twenty-six seniors representing eight Negro high schools in Alabama completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Westinghouse Science Scholarships.

Of these students three were selected as finalists and were invited to the Southern Research Institute for an interview by the judges on June 10, 1961.

The Negro finalists were interviewed by the Scholarship Committee on June 10, and the winners were announced that afternoon.

	Name	**High School**
1st Award	Quincy H. Shelton	Brantley
1st Alternate	Brenda Flournoy	J. W. Darden
2nd Alternate	Calvin K. Williams	Parker

Judges

John B. Beck
James M. Boyles
Robert E. Burk
R. L. Chermock
K. W. Coons
Bessie Davey
Henry C. Dorris
Andrew Douglas
James B. Dozier
Charles E. Feazel, co-chairman
Arthur F. Findeis
Kenneth M. Gordon
W. C. Guest
Shirley E. Gunter
T. I. Hicks
Alan Hisey
J. A. Holman
James L. Kassner
G. Lloyd Martin
Herbert A. McCullough
Julian D. Mancill
Edward A. Munns
Walter J. Rheim
William J. Rimes
Eric Rodgers
Charles L. Seebeck
A. J. Still
Wynelle D. Thompson
William L. Tilson
E. N. Todhunter
Arthur J. Tomisek
John Wharton
R. E. Wheeler
Robert N. Whitehurst
W. J. Wingo
Charlton W. Winsor, co-chairman
James W. Woods
E. C. Wright

FINALISTS IN THE ALABAMA STATE SCIENCE TALENT SEARCH, 1961

White Contestants	College Attending	Scholarship	Major
Copeland, D. A.	University of Alabama	Tuition Scholarship	Chemistry
Grimes, Victor S., Jr.	University of Alabama	Gorgas Scholarship $900 per year plus tuition	Aerospace Engineering
Hamner, G. F., Jr.	University of Alabama	Gorgas Scholarship $1800 per year plus tuition	Physics—Mathematics
Holmes, L. C.	University of Alabama	Tuition Scholarship	Mathematics
McCoy, N. K., Jr.	Vanderbilt University	Navy ROTC Scholarship	Physics
McDermott, W. E.	Air Force Academy	None	Physical Chemistry
Miller, H. R.	Birmingham Southern	Gorgas Scholarship $750 per year plus tuition	Chemistry
Morgan, G. C.	Auburn University	None	Mechanical Engineering
Palmer, Joan K.	Auburn University	Gorgas Scholarship $1350 per year plus tuition	Premedical
Stalla, Mark E.	Georgia Tech	Navy ROTC Scholarship	Physics—Electrical Engineering
Negro Contestant			
Shelton, Quincey H.	Tuskegee Institute	Gorgas Scholarship $1800 per year plus tuition	Chemistry

THE ALABAMA JUNIOR ACADEMY OF SCIENCE

Proceedings of the Twenty-Seventh Annual Meeting

Spring Hill College, Mobile, April 7-8, 1961

The caucus of officers, official delegates, and nominees for office was called to order by the President, Jeanette Lyles, at 10:00 a.m. in the College Inn. Mr. Reuben Boozer was present. Those schools attending this convention were:

Schools	Official Delegate
Athens	Michael Whitt
A. G. Parrish	Bill Ehlut
Baldwin County	
Bishop Toolen	Ammette Barton
C. F. Vigor	
Choctaw County	Richard Harmon
Dora	Curtis W. Ellison
Ensley	Jim Stewart
Foley	Linda Holk
Huntsville	Jim Stull
John Carroll	William McDermott
Julius T. Wright	
Marion Military Institute	Thomas W. McCormick
McGill Institute	
Mercy	Dicky Turpin
Minor	James Hill
Montevallo	Brenda Morris
Murphy	Betty Brandon
Satsuma	Beverly Baker
School of Organic Education	Ron Ferguson
Semmes	Sandra Hipsh
S. R. Butler	Susy Jean
St. Bernard	Paul Mejia
Charles Henderson	John M. Riddle
Tuscaloosa	
West End	Kenneth Watts
Woodlawn	Steven Oliver
Shades Valley	Kaye Dyar
*Citronelle	Marian Clark
*University Military School	

*Reinstated

Other schools were given charters as new chapters. They are: Tanner, Alexandria, Boaz, Cherokee County, Crossville, Etowah, Glencoe, Handly Stevenson, White Plain, Ranburne, Cedar Bluff, Ragland, Enterprise, Walter William, Cleburne County, Peedman, Pike County, Robertsdale, and Jackson, none of which were present at the convention.

The secretary called the roll. The President asked that as the minutes of last year's convention were sent to each school after the convention and in September, that we dispense with the reading of them. This was unanimously accepted. Jeanette then read the list of schools to be given new charters. The candidates were then asked to leave the room.

Each of the nominees was brought in individually to speak in his own behalf after Jeanette had given a brief run-down of his qualifications. The name of each candidate was written on the board as he came in.

Jeanette cited several of the rules governing the campaigning for office as the Vice-President and Secretary counted the votes. The following slate of officers was selected:

President—John Thornton, Huntsville; Russell McLemore, Murphy
Vice-President—Sarah Campbell, Dora; Harold Robinson, Semmes
Secretary—Charles E. Stewart, Minon
Treasurer—Bob Lumpkins, John Carroll

The offices of secretary and treasurer were not voted on as there was only one candidate for each office.

Paul asked that the two candidates for Vice-President meet with him after the caucus. Jeanette explained that these candidates, Paul, and other chosen people would constitute the resolutions committee. Paul explained that the purpose of this committee is to pay public tribute to those people who helped with local arrangements.

Each of the nominees for office was given a ribbon to wear until the election of officers.

The 11:00 a.m. business meeting was held in the College Inn. Jeanette called the meeting to order and asked that all official delegates come to the front of the auditorium. The secretary called the roll. The names of the schools to be given new charters were read and these schools were asked to get their charter. Jeanette announced that a representative from the club must be present at the exhibits during the judging of these exhibits. Jeanette then introduced Dr. Wheeler, who made several announcements concerning recreational facilities for the afternoon and the banquet for that evening.

Paul announced that the following would be on the resolutions committee which would meet immediately following the meeting:

Chairman—Paul Schultz, Jr., Foley
Sponsor—C. J. McSpadden, Foley
Co-Chairman—Russell McLemore, Murphy; Sarah Campbell, Dora; Harold Robinson, Semmes.

It was at this meeting that the candidates for office and their campaign managers gave their campaign speeches.

As there was no further business, the meeting was adjourned until 8:30 a.m. Saturday in the College Inn.

The annual banquet of the Alabama Academy of Science and the Alabama Junior Academy of Science was held at the Fort Hardeman Armory at 7:00 p.m. Both Jeanette Lyles, President of A.J.A.S., and Mr. J. R. Goetz, President of A.A.S., gave Presidential Addresses. Dr. C. W. Winsor announced the Gorgas Scholarship winners. After this there was an address by Dr. J. P. Kuettner, Chief of Project Mercury-Redstone, Huntsville, Alabama.

Following the banquet the Junior Academy enjoyed a party at the Fort Hardeman Armory.

At the 8:00 a.m. General Assembly Jeanette announced each of the regional papers as they were read by the winners.

Following the reading of these papers Jeanette called a ten-minute break before the business meeting.

Jeanette Lyles called the 9:00 a.m. business meeting to order. She asked that all official delegates come to the front of the auditorium. She then read the list of nominees for each office and asked that the nominee stand as his name was called. Paul Schultz and Lynda Mia Persson distributed and collected the ballots.

As the votes were being counted Elina Tyrrell gave the treasurer's report which stated:

As treasurer of the Alabama Junior Academy of Science for 1960-61, I submit this annual report.

Dues collected (83 schools)	$166.00
Membership cards sold	28.50
Total receipts	$194.50
I have deposited	$202.50
Expenditures, Checks	13.00
	189.50
Service charges	1.12
Balance brought forward	$188.38

Paul Schultz, Vice-President, then submitted the following statement:

Be it resolved that the Alabama Junior Academy of Science go on record as extending thanks to the following:

Dr. Hemphill and Dr. Keasley, who, as counselors of local arrangements, with the help of other members of the Spring Hill College, have made our visit most enjoyable. The Mobile Region of the Alabama Junior Academy of Science, whose officers, sponsors and members have assisted in the very smooth operation of this convention.

Mr. D. F. Butler, Chairman of Judging, and his corps of judges who did a thorough job.

In a marked manner we render our gratitude to the following persons for their time and effort displayed in our behalf: Rev. George O. Twellmeyer, State Coordinator of Science Fairs, Dr. James L. Kassner, State Coordinator of Science Clubs of America, Mr. D. F. Butler and Mr. Reuben Boozer, our Associate Counselors and to Dr. Emmett B. Carmichael, Chairman of the Gorgas Scholarship Foundation.

We especially thank the members of the Senior Academy and Mr. J. R. Goetz, President, who made our joint banquet and the entire convention a rousing success.

We extend thanks to Dr. J. P. Kuettner for his entertaining and informative talk at the banquet and also to all participating clubs for their part in the entertainment at the party.

A special tribute of gratitude is extended to Dr. R. E. Wheeler, Permanent Counselor, who with unstinting generosity has served the organization during the entire year, to our President, Miss Jeanette Lyles, her capable officers, and their sponsors, and to the management of the Battle House Hotel who made our stay most privileged and enjoyable.

A special vote of thanks goes to the Mobile Academy of Science and its supporting industries for their teacher substitution program, without which many of our local counselors and sponsors would have been unable to attend.

Our deepest and most sincere expressions of gratitude go to one of our most important supporting industries, Mrs. Lloyd, without whom neither the A.J.A.S. nor the Mobile Region has been able to function for the last 17 years, and which organizations we are positive must still call upon her from time to time to straighten things out.

A copy of these resolutions will be sent to each person and staff mentioned.

Jeanette Lyles then announced the new officers for 1961-62 in reverse order. These officers were as follows:

President—John Thornton, Huntsville
Vice-President—Sarah Campbell, Dora
Secretary—Charles E. Stewart, Minor
Treasurer—Bob Lumpkin, John Carroll

Dr. Wheeler announced that the awards to the officers would be sent to them as they had not come in.

The cup given to the Region who contributed most to the Academy went to the Mobile and Northeastern Regions. The two were to divide the year in half, each keeping the cup six months. Mrs. Lloyd said that since the Northeastern Region was young, that she with the permission of the Mobile Region would let the Northeastern Region keep the cup all year.

Dr. Wheeler announced there would be an executive meeting following the business meeting in the Teachers Common.

The Executive Committee met in the Teachers Common immed-

iately after lunch. Those present were Dr. R. E. Wheeler, R. O. Tatum, Elina Tyrrell, Paul Schultz, Jr., C. J. McSpadden, Clustie McTyeire, Mary E. Ward, Jeanette Lyles, Lynda Mia Persson, Bob Lumpkins, I. K. Bradford, G. O. Spencer, D. F. Butler, F. J. Kearley, Jr., John Thornton, Claudia Smith, Charles Stewart, F. A. Caggions, A. F. Hemphill, and Sarah Campbell.

Dr. Wheeler made the statement that the Academy will have to run on a more strict budget next year. There were other discussions but none were decided on.

The Senior and Junior Academy met jointly for the 10:00 a.m. business meeting. Paul Schultz, Vice-President of the Junior Academy, presided. He introduced Dr. Wheeler, who in turn introduced the regional sponsors.

The sponsors then introduced the presidents of their regions, who gave a brief history of their region. Each region was reported progressing.

Paul Schultz thanked the counselors and officers for their work in the scientific field.

Dr. Wheeler announced the winners of the exhibits and papers and presented the awards. These were as follows:

	Chemistry
First Place (10" cup)	Alexis Carrell Science Club, "Studies in Nonaqueous Chemistry—The Allou-Lattice Model."
Second Place (8" cup)	McGill Science Club, "Fuel Cell"
	Physics
First Place (10" cup)	Slocomb Science Club, "Study of Atomic Particles by use of Cloud Chambers"
Second Place (8" cup)	Shades Valley Science Club, "My Work With the Complex Unit A $\pm$ Bi"
	Science In Industry
First Place (10" cup)	Sigma-Alpha-Sigma Science Club, "Chemistry In Art"
Second Place (8" cup)	Organic School Science Club, "Seaing with Sonar"
	Biology
First Place (10" cup)	Huntsville Science Club, "Paramecia Photomicrography"
Second Place (8" cup)	Electron Club, "Natural Selection in *E. coli*"
	Papers
First Place (10" cup)	James McAleer, McGill Institute
Second Place (8" cup)	Victor Grimes, Huntsville High School

Paul Schultz adjourned the meeting.

REGIONAL SCIENCE FAIR EXHIBIT WINNERS

Mobile Region

James McAleer, McGill Institute, Mobile
Melinda McGill, Marietta Johnson of Organic Education, Fairhope

Central Region

Joan Palmer, John Carroll High School, Birmingham
George Hamner, Tuscaloosa High School, Tuscaloosa

North Region

Hugh W. Greene, Morgan County High School, Hartselle
Marilyn White, Athens High School, Athens

Northeastern Region

Omer Lee Burnett, Sylacauga High School, Sylacauga
Joe Upchurch, Talladega High School, Talladega

Southeastern Region

Billy Bishop, A. G. Parrish
Catherine Camfe, Selma

ALABAMA JUNIOR ACADEMY OF SCIENCE EXHIBITS

Chemistry

Solu-Dynamics	Foley High School (Paper) C. J. McSpadden
Fuel Cell	McGill Institute Brother Moore, S. C.
Study in Nonaqueous Chemistry—The Alloy-Lattice Model	John Carroll High School Mr. Frank Caggianno

Physics

Underwater Transmitting and Receiving	Woodlawn High School (Paper) Pauline K. Long
Study of Atomic Particles by use of Cloud Chambers	Slocomb High School
Demonstration Binary Computer	Dora High School Dorothy S. Ellison
The Electromagnetic Series and Sound Waver	Woodlawn High School Pauline K. Long
Telescope	Marion Military Institute Capt. Faile
Comparing Electrostatic and Electromagnetic Fields	Foley High School C. J. McSpadden

Plasma Flame	West End High School Mary E. Hafling
Surfaces and Intersections	St. Bernard Rev. Lawrence Phillips, A.S.B.
My Work With the Complex Unit A±Bi	Shades Valley High School Mrs. E. Huffman

Science In Industry

Chemistry In Art	Julius T. Wright High School Mrs. Don Pierce
Seaing With Sonar	Organic High School Verda Horne
The Air Car of Tomorrow	Montevallo High School Miss Ethel Harris

Biology

Regeneration of the Earthworm	Dora High School (Paper) Mrs. Dorothy S. Ellison
Paramecia Photomicrography	Huntsville High School Mrs. Mary Graves Barke
Natural Selection in *E Coli*	Ensley High School Miss Virginia Naucarrow
Extraction of Leaf Pigments	Choctaw County High School Mrs. Vivian Gilmore
Certain Responses of Microscopic Animals To Vitamins	Semmes High School Mrs. Mary E. Ward

Respectively submitted
Lynda Mia Persson
Secretary of AJAS

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal, should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
HOWARD COLLEGE
BIRMINGHAM, ALABAMA

VOLUME 32 OCTOBER, 1961 NUMBER 4

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 32 OCTOBER, 1961 NUMBER 4

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

Abstracts of Papers Presented at Section Meetings

ABSTRACTS

Section I—Biological Sciences

An Interspecific Hybrid in Vicia

E. M. Clark and E. D. Donnelly[1]
Auburn University

An interspecific hybrid between *Vicia sativa* (Alabama 1894) and *V. angustifolia* (PI 121275) was obtained. White-flowered, soft-seeded *V. sativa* (2n=12) was used as the female and pulple-flowered, hard-seeded *V. augustifolia* (2n=10) was the male. The F_1 was purple-flowered, more vigorous than either parent, highly sterile (ca 94%) and had a chromosome count of 2n=11. Meiosis in the F_1 was highly irregular. Pairing ranged from one pair with 9 univalents to 5 pairs with one univalent, 3 and 4 pair types being the most frequent. In the F_2 there was segregation for flower size and color, vigor, earlines, percentage of hard seed, and seed size and color. Sterility in the F_2 ranged from 3% to 98% and hard seed from 0% to 96%. The occurrence in the F_2 of sativa-type plants with low sterility, and high percentage of hard seed gives promise of success in introducing the hard-seed character into otherwise desirable *V. sativa* varieties.

A Comparison of the Chemical Composition of Three Varieties of Runner Peanuts

N. D. Davis
Auburn University

The Dixie Runner variety of peanut has been grown extensively in Alabama for many years. Early Runner and Virginia Runner G-26 varieties are comparatively new in the state. Reports on the chemical composition of Early and G-26 varieties have not been previous published. This research reports on a comparison of the chemical composition of these three runner-peanut varieties.

The oil content of Dixie, Early, and G-26 differed, averaging 47.6, 48.6, and 52.5%, respectively. The peroxide value of Dixie was 1.5; of G-26 and Early was each 1.0. Divie was comparatively low in

---

[1] Department of Botany and Plant Pathology and Department of Agronomy and Soils, respectively.

carbonyl compounds with 0.45 mg/kg. of oil as compared with 0.65 for G-26 and Early. G-26 had the highest per cent free fatty acids, 0.40% as compared with 0.22% for Dixie and Early. The iodine value of Dixie was 91.2, Early was 90.7, and G-26 was 91.0.

Average tocopherol content was 0.10 mg./g. in Dixie, 0.12 in Early. and 0.13 in G-26. Dixie was highest in total introgen with 4.4% of the kernal dry weight as nitrogen. Early had 4.3% and G-26 had 4.1% total nitrogen. The three varieties were essentially the same in per cent protein nitrogen. The protein nitrogen content of Dixie and Early averaged 3.8%, and G-26 averaged 3.7%, of the kernal dry weight. G-26 was highest in total sugars with 28.8 mg. of sugar/gm. of peanut. Dixie had 27.5 and Early only 23.3 mg./g. Other differences noted were taste and germinability. G-26 was consistently rated the best tasting. Dixie and Early were rated equal in palatability. Dixie and Early germinated readily after curing, germinability being greater than 70%. G-26 gave only 10% germination immediately after curing, and required a rest period of several weeks before germinability reached 70%.

Differences in the chemical composition of the three varieties were not great enough to be used as a criterion for variety recommendation. However, differences do exist in oil content, sugar content, taste, and germinability. A knowledge of these differences might be important when these varieties are being bought or sold for spcific purposes, i. e. for direct use as food, for oil production, or as seed peanuts.

Growth of Fungi on a Medium Containing Oleic Acid

Urban L. Diener and Norman D. Davis
Auburn University

Previous investigations have shown that at least 10 species of fungi occur abundantly on stored unshelled peanuts. When two of these storage fungi (*Aspergillus tamarii* and *A. candidus*) were grown on a 10% liquid peanut medium, they developed mycelial mats, produced large amounts of carboxylic acids, and raised the H-ion concentration of the medium from an initial pH 3.0-6.0 to pH-8±0.3. Increased growth was obtained in shake culture as compared with standing culture.

An evaluation of the oil components of the peanut as a sub-

strate for fungi was initiated. The fungi were grown in Czapek-Dox mineral salts solution in which a fatty acid was substituted for sucrose as the carbon source. About 1g of agar was added per liter to stabilize the emulsion. The medium was homogenized with a Fisher hand homogenizer or a Waring blendor, and 50 ml placed in each of several 250-ml Erlenmeyer flasks. The culture flasks were placed at 30° C in a constant temperature incubator-shaker.

A. tamarii grew well on such a medium containing 0.1 to 32% oleic acid. In a medium containing 16% oleic acid, *A. tamarii, A. candidus, A. chevalieri, A. amstelodami, A. repens, Penicillium citrinum,* and *Cladosporium sp.* produced well-developed mycelial mats in 7 to 30 days, whereas *A. rubrum* and *A. restrictus* failed to grow under these conditions. Studies are being continued to determine the growth of these fungi on linoleic, palmitic, stearic, and other components of peanut oil.

Macroscopic and Microscopic Anatomy of the Canine Eye
Post-natal Development of the Canine Eye

Dr. R. D. Whiteford
Auburn University

During a period of two and one-half years, the eyes of 16 dogs were studied macroscopically and microscopically to determine the structure of the mature eye and to describe the growth changes that occurred from birth to two years of age. It was found that the canine eye is structurally mature at 6-8 weeks of age. At birth, the eye has the form of a sphere; at the age of 6 weeks it has the form of an oblate spheroid, the form typical of the mammalian eye. The direction of growth is not constant. The eye grows most rapidly the first 8 weeks of post-natal life, and reaches growth maturity at 28 weeks of age.

There are specific details of structure that vary from the human eye. The most outstanding of these are:

1. A larger, more sharply curved cornea.
2. A cellular type of tapetum lucidum subserving acute vision.
3. Pigmentation is more conspicuous than in man.

4. A macula lutea and fovea centralis are absent in the retina; a rod-free zone in the retina is also absent.
5. A physiologic depression as seen in the human eye is absent in the optic papilla.
6. The anterior chamber angle contains a meshwork partially filling the angle. The canal of Schlemm, as an anatomical structure is absent in this area.
7. "Aqueous canals" connecting the chamber angle and the plexus of Hovius are described for the first time in detail.

The Auburn Environmental Chambers for Avian Physiological Research

J. R. Howes, W. Grub, and C. A. Rollo
Auburn University

During 1960 three identical buildings 32' x 30' x 9' were constructed at the Poultry Unit of the Auburn Agricultural Experiment Station. These wooden buildings have cement floors, homosote walls and roof, masonite ceilings, heavy duty roll roofing and the entire outside roof and walls are white. Two of the buildings contain 12 environmental chambers, six in each building, while the third house is equipped with laying cages and fans to serve as a control fan ventilated laying house.

The twelve 10' x 8' x 7' chambers are insulated with fiberglass and the walls both inside and out painted white to reflect light and heat. The two units of six rooms were constructed so as to provide a wide central corridor giving access to each chamber, and an area at the back and sides of the chambers was also left to service equipment and act as additional insulation.

Each chamber is designed to provide the same environment and is equipped with a heat pump for temperature control, humidifiers and dehumidifiers for humidity control, fans for air movement, and rationed light by means of time clocks. Instruments are also provided in each chamber and the control house to measure temperature and huimidity. Each chamber has 44 laying cages.

After extensive testing the equipment was started for trial one

in December, 1960. H3W strain S. C. White Leghorn pullets specifically raised for this work were introduced into the chambers. These birds of uniform background are on test to evaluate the effects of six different temperatures, 50, 60, 70, 80, 90 and 100°F, the relative humidity, air movement, light, diet and management being identical for all six treatments. Each house contains one replicate of the six treatments and collected data are being placed on I.B.M. cards for statistical analysis. A weather station is maintained in close proximity to the house to record the outside environment. A brief review of the data collected to date from these chambers will be presented.

An Interrelation Between the Thyroid and Adrenal Gland

Kenneth Ottis
Auburn University

Previously performed experiments in this laboratory seemed to indicate that both the thyroid hormone and adrenaline must be present in the white rat in order to demonstrate increases in B.M.R.

Three groups of animals, ten per group, were thyroidectomized and put on drinking water containing Thiouracil. One intact group was also put on Thiouracil, and another group left intact and untreated as controls. Weekly weight records were kept on all experimental animals to determine the effectivness of the thyroidectomy. Groups III and IV, (athyroid-TU treated) were given 5 ug. of T_3 daily followed by oxygen consumptions, blood sugar and plasma-cell determinations, pre and post injections of 50 ug. of adrenaline. After a rest period of 10 days, this regimen was repeated with the animals being pretreated with chlorpromazine hydrochloride, a proposed adrenolytic tranquilizer compound.

Pretreatment with 5 mg. of chlorpromazine per 100 g. of body weight tranquilized the animals within 15 minutes, lowered the B. M.R. of the T_3-adrenaline treated animals but did not significantly alter the glycogenolytic effect of the catechol amine in the liver.

A Modification of the Dilution-Plate Method for Isolating Soil Fungi

Norman C. Schenck
University of Florida
E. A. Curl
Auburn University

The dilution-plate method is widely used for isolating fungi from soil. Although satisfactory in many respects, this method is time consuming and requires excessive glassware. A study was undertaken to develop a rapid method that would yield quantitative and qualitative results comparable to the dilution-plate. The new "dropper" method, the dilution-plate, and the recently suggested "soil-sand" method of Johnson and Manka were compared in processing samples of Susquehanna clay, Chesterfield sandy loam, and Norfolk fine sandy loam soils. The procedure for the dilution-plate was essentially as outlined by Johnson, et al. in "Methods for Studying Soil Microflora-Plant Disease Relationships." The "soil-sand" method is a modification of the Warcup soil-plate in which soil samples are diluted with sand prior to plating. In the "dropper" method, 0.05-gram samples of each soil were placed in screw-cap vials with 20 ml. of sterile water and shaken by hand. Part of the suspension was then removed with a medicine dropper and two drops (approximately 0.1 ml.) were plated. The cultural medium used was peptone-dextrose agar with rose bengal and streptomycin sulfate. Statistical analyses of the results showed that the "dropper" method compared favorably with the dilution-plate in both numbers and species of fungi isolated. The "soil-sand" method was equally as effective as the other methods only when the soil:sand ratio was 1:1. Both the "dropper" and the "soil-sand" methods, because of their simplicity, may be useful where large numbers of soil samples are to be processed.

The Comparative Composition of Blood of Hereford (Bos taurus) and Brahman (Bos indicus) Cattle

J. R. Howes
Auburn University

During the 1957-1959 period the author conducted comparative physiological studies with Hereford and Brahman cattle at Gainesville, Florida. Hematological investigations were undertaken in an

attempt to further resolve the marked differences between the two species in their abilities to withstand heat stress. It was believed that since Indian cattle were evolved under relatively lower intakes of dietary protein, they might respond differently if offered high and medium levels of protein. The experimental animals of both species were divided at random into two treatment groups. Treatment one received the nutrient allowances as recommended by the National Research Council, while treatment two had similar management and diet except for a 50 per cent reduction in protein. Over 100 animals between the ages of a few months and 4 years were studied.

The erythrocyte count was significantly greater for the Brahman and the group receiving the higher protein. There was a decline in erythrocyte count during the first year of life and there was a lower count during hot weather indicating hemodilution. The diet, age and season differences were not so apparent for hematocrit and hemoglobin measurements, but there were significant species differences.

Results from a relatively small number of analyses for venous blood gases revealed a significantly higher CO_2 content for the Herefords. There were no significant differences in 0_2 content, 0_2 capacity, or percentage 0_2 saturation, but these three parameters did exhibit significant differences with age.

Plasma volume was measured with radioactive serum albumin and blood volumes calculated with hematocrit values. Brahmans possessed significantly more blood, plasma and red cells per unit of body weight, which would give this species additional hematological advantages for greater respiratory efficiency and the elemination of body heat. There were no significant seasonal trends in blood, plasma or red cell volumes per unit of body weight, but the older animals possessed significantly more of all of these parameters.

Effects of Ultrasound on Nematodes

E. J. Cairns
Auburn University

Experiments with soil and plant nematodes were conducted with a 40-watt ultrasonic generator operating at a frequency of 90,000 cycles per second. Specimens enclosed in small vials were immersed in water in a half-gallon capacity treatment tank. Nematodes sus-

pended in water were killed within seconds, whereas longer exposure times were necessary to kill nematodes in moist sand. Small nematodes were more resistant to ultrasound than were larger forms. Death of the nematodes sometimes appeared to result from mechanical damage evident as tissue injury or total disintegration; however, death also occurred when injury was not apparent. The results to date suggest that ultrasound may be practical for disinfestation of objects and plant parts having surface-borne nematodes.

. . . .

Effects of Plant Residues on Growth of Sclerotium rolfsii Sacc.

Aubrey C. Mixon[1]
Auburn University

Laboratory experiments were conducted to determine the effects of plant residues on growth of the plant pathogen *Sclerotium rolfsii Sacc.* Air-dried leaves and stems of clover, vetch, oats, and peanuts, and leaves of corn were used.

A fatter extract of clover provided the best nutrient solution for mycelial growth of the fungus, whereas oat extract retarded growth. Growth in peanut and vetch extracts was less than that in clover extract, but greater than that in corn or oat extracts. The addition of soil extract and 2% sucrose to the plant extracts resulted in increased growth, but the differential effects of the plant extracts persisted.

Differences in effects of these plant residues on linear growth of the fungus were not as striking when finely chopped plant parts were used as the initial food base at the ends of growth tubes containing agar or soil. Growth of the fungus from these materials, however, proceeded at a more rapid rate over the surface of agar than through soil. The average daily growth rate of mycelium was greatly increased and relatively constant on agar in which the plant material had been evenly distributed throughout the lengths of the growth tubes. Results relative to the effects of residues on linear growth were different from results on growth in liquid cultures.

The influence of residues on sclerotium production was determined by culturing the fungus in flasks of soil-sand amended with

[1] U.S. Agricultural Research Service and Alabama Agricultural Experiment Station cooperating.

chopped air-dried plants. Significantly more sclerotia were produced in soil-sand amended with chopped oats or corn than in soil-sand amended with vetch, peanuts, or clover.

In general, residues that stimulated greatest sclerotial production supported largest sclerotia as indicated by comparative dry weights. Plant residues that induced greatest mycelial growth in liquid cultures stimulated least sclerotium production in soil-sand.

Residues of corn and oats incorporated into water agar significantly reduced germination of sclerotia, whereas residues of clover, vetch, and peanut in agar had no detrimental effect.

The Utilization of Transplantable Hamster Tumors as a Tool for Evaluating Potential Anticancer Agents

J. Richard Thomson and Jack H. Moore
Southern Research Institute

Experimental cancer chemotherapy is performed by most investigators employing well established, transplantable mouse and rat tumors (for example: Sarcoma 180, Adenocarcinoma 755, and Walker 256). These tumors are characterized by fairly uniform growth rates and reproducible inhibition by certain "active" anticancer agents. A point of controversy is that many investigators do not believe that these tumors are analogous to their human counterparts since they metastasize poorly, if at all.

We have used some eighteen hamster tumors isolated and established by Dr. Joseph Fortner, of Sloan-Kettering Institute, in a secondary screening program to evaluate the effects of a group of selected "active" anticancer agents against these tumors. Sixteen of these tumors are characterized by widespread metastasis (lymph nodes, liver, heart, lung, etc.) following subcutaneous implant. Through the use of these tumors, a double criterion of judging the effectiveness of new drugs is possible: 1) their inhibitory action on the primary tumor implant, and 2) their inhibitory action or retardation of metastatic spread of the tumor.

Kodachrome slides made at close range will be presented showing normal tumor growth and sites of metastatic spread. Data will be presented showing inhibition of these tumors with certain antimetabolites and alkylating agents. The biological implications of such a screening system will be discussed.

Summer Research in a Physiology Laboratory[1]

Pauline K. Long
Woodlawn High School

The work was done in Dr. Charles D. Kochakian's physiology laboratories at the University of Alabama Medical Center. These experiments were directed at learning more about the interlocking relationships of hormones, enzymes, amino acids, ribonucleic acid and desoxyribonucleic acid as the basis of cell growth and function This is the basic science area which may eventually answer the questions of what causes cancer and how to cure it.

Experiments this summer were to find the effects of enzymes, hormones, the androgens), soluble ribonucleic acid, desoxyribonucleic acid and magnesium upon protein synthesis. Most important of all were the amino-acid activating enzymes which carry on the energy exchanges for this formation. The androgens' effect upon protein synthesis is studied by the effects of castration or of testicular insufficiency and the repair of these changes by the administration of androgens.

Results from these experiments lead to the conclusion that the protein metabolic effects of the androgens vary according to the animal and the organ studied. The mechanism of this action must depend upon intermediary processes. Detectable responses on the accessory sex organs are found in both mice and guinea pigs.

The androgens possess metabolic effects upon the muscles (the best example being the temporal muscle of the guinea pig.

The RNA increase apparently precludes the weight increase but the DNA increases only slowly (apparently by growth mitosis) and the change seems much greater than that required for normal growth. These experiments lead to the conclusion that only part of the DNA is metabolically stable; in the seminal vesicles, radioactive incorporation in the normal animal tissue is thirty times that required by normal replacement mitosis. Androstanedione, a weak androgen, causes slow growth of prostate and seminal vesicles; yet the RNA concentration in the slow-growing tissue is the same as that in fast-generating tissue with methytestosterone. This can be explained by assuming that a strong androgen catalyzes the exchange between RNA and amino acids either yielding protein, or by the blocking of the androstanedione of RNA incorporation by enzymes.

[1] Sponsored by an American Cancer Society grant.

Since the soluble RNA is not increased in regenerating tissue (as concentration) rapid growth may be assumed as the incorporation of RNA into the enzymes which catalyze the synthesis of protein.

Evidence at present suggests that separate enzymes are involved in the activation of each amino acid. It is also believed that there are separate species of soluble RNA corresponding to different amino acids. Tryptophane and valine are especially sensitive to magnesium. Leucine and isoleucine are sensitive to a small extent as shown by one group of experiments.

Effect of Temperature and pH on Growth and Production of Carboxylic Acids by Aspergillus tamarii and Aspergillus candidus[1]

Norman D. Davis and Urban L. Diener
Auburn University

A nutrient medium, prepared from peanuts, was found to support abundant growth of filamentous fungi. The medium was prepared by homogenizing peanuts in water in a Waring Blender and filtering through glass wool. The extract was autoclaved and inoculated with *Aspergillus tamarii* or *Aspergillus candidus*. At weekly intervals the dry weight of mycelium, and the milliequivalents of carboxylic acid produced were determined. The effect of temperature, time and initial pH on mycelium and acid production were studied. Results indicate that in *A. tamarii, growth* and acid production are opposing processes. In *A. candidus* this is true with respect to time and pH but not with respect to temperature.

Growth of *A. tamarii* was greatest at temperatures near 20°C and decreased as temperature increased. Acid production by this organism was favored by higher temperatures, up to 350°C, and by a pH of about 6.0. Maximum growth was attained the first week and at a pH of about 9.0, during which time little acid was produced. After the first week, further growth did not occur but acids began to accumulate, and continued to accumulate throughout the five-week experiment.

Growth of *A. candidus* was also favored by low temperature

[1]Biology Section, Alabama Academy of Science, Montgomery, Ala. April, 1960.

and high pH and occurred mostly during the first week. Acid production appeared to be favored by low temperature also and a pattern of acid production different from that of *A. tamarii* occurred. In *A. tamarii, acids* accumulated throughout the duration of the experiment whereas in *A. candidus* this was true at 20°C, but at all higher temperatures the acids accumulated for 3 or 4 weeks and then were reutilized by the organism, disappearing from the medium.

Further work is being conducted to determine other conditions conducive to maximum acid production.

Isolation of Soil-Borne Fungus Populations[1]

J. A. Lyle

Auburn University

Fungal populations of the soil may be changed extensively both qualitatively and quantitatively by certain environmental factors, including growing plants. Various methods have been devised to obtain cultures of fungus microorganisms from soil. Sterile polyethylene tubes, inserted in soil to depths approximating 3 inches, have been used with marked success in Norfolk sandy loam and Sumter clay soils in southeast and southwest Alabama, respectively for determining populations of fungi around the roots of peanut, Caley pea, oat, and wheat plants.

Twenty-five ml. of acidified potato-dextrose agar were aseptically pipetted into each tube. All tubes were then slanted and held for 48 hours at room temperature to determine if contamination occurred. Two holes, one inch apart and 1/16 inch in diameter, were bored into the slanted side of all polyethylene tubes with a sterile electric drill. Both holes were covered externally with a strip of Scotch tape, and the tubes were held at room temperature for 24 hours again to determine if contamination occurred. The tubes were inserted in each kind of soil and remained therein for 24 hours. They then were returned to the laboratory and maintained at room temperature for 7-10 days, after which all fungi growing in the tubes were identified to genus or species.

---

[1]Biology Section, Alabama Academy of Science, Montgomery, Ala., April 1960.

In the Norfolk sandy loam soil the following fungi were obtained most frequently: species of *Fusarium, Penicillium, Rhizoctonia, Rhizopus,* and *Sclerotium bataticola,* and *S. rolfsii.* In the Sumter clay soil the following fungi were obtained most commonly: species of *Diplodia, Fusarium, Rhizopus,* and *Helminthosporium sativum,* and *H. victoriae.*

Abnormalities in Embryonic Development of the Coturnix Quail[1]

Carol A. Smith Padgett and Phyllis Smith Dice
Huntingdon College

In a total of 578 incubated eggs of the Coturnix quail, *Coturnix coturnix japonica,* 13.0% of the embryos were abnormal in some respect.

Abnormalities found:

1. yolk sac deformities
2. malpositions serious enough to prevent hatching
3. foot deformities
4. perocephaly
5. visceral anomalies
6. incomplete twinning
7. abnormally small (malnutrition)
8. complete twins

Those with yolk sac deformities including ruptured yolk sac, incomplete inversion of sac, and those with sac wrapped around the feet. Of the malpositions occurring in the embryos, only those with the embryo rotated with beak away from the air cell or with beak over one right wing were encountered frequently, and those with their heads in the small end of the egg were seen in a few cases.

Anomalies included in foot deformities were turned-in, club-footed conditions, toes severely bent, and feet drawn into a tight ball.

Perocephaly (deformed head) was exhibited in various degrees. The main condition found in the *Coturnix* was where the cranium had failed to form over the cerebral hemispheres.

Visceral anomalies included extremely large, protruding hearts,

---

[1]Biology Section, Alabama Academy of Science, Montgomery, Ala., April 1960.

undeveloped abdominal walls, and liver descended into lower abdomen.

In the few cases of incomplete twinning, multiple sets of wings and legs were found but visceral abnormalities were only slight.

In the embryos which were extremely small yet fully developed, the liver was usually disproportionate, being either too small or too large.

Yolk sac deformities, malpositions, and foot deformities all seem to be caused by unfavorable incubation procedures, especially high temperature (above 100°F.) or low humidity (below 50%). Parental nutrition could also be a causative factor.

Perocephaly is possibly caused by a genetic factor in the Coturnix as it is in chickens.

Malfunction of the liver metabolism would be indicated in cases of embryos underdeveloped in size since the disproportionate livers were found.

Since twinning, both complete and incomplete, was rare, there is no evidence at present that inherited factors are involved.

Section II Chemistry

The Use of Inclusion Compounds to Control Carbohydrate Reactions

Harmon L. Hoffman, Jr.

Southern Research Institute, Birmingham, Alabama

The literature contains a number of references to inclusion compounds wherein molecules of one species are trapped in the interstices formed during crystallization of a molecule of another species. It has been shown that the inclusions does not involve chemical bonds and that chemical stoichometry is inapplicable in considering the inclusion principle. The formation of inclusion compounds is limited largely by the physical dimensions of the "host" cage and the "guest" molecule.

Most of the "guest" materials in inclusion compounds have been liquids or gases. However, we believe, from the apparent structural

dimensions of some of the more promising "host" molecules that it may be possible to include carbohydrates in the crystalline materials.

The object of this work has been to study the preparation of inclusion compounds containing carbohydrates as "guest" molecules, and if such inclusion compounds can be made, to try the inclusion principle as a means of controlling chemical reactions, such as oxidation, applied to carbohydrates.

A survey is given, describing some of the materials that are considered the most likely prospects as "host" molecules for including carbohydrates. Several new products are described that are considered to be inclusion compounds containing carbohydrates.

The Effect of Desoxycorticosterone Acetate (DOCA) on Glycogen Formation in Liver and Skeletal Muscle of the Albino Rat

William Niedermeier and Emmett B. Carmichael
University of Alabama Medical Center

DOCA has been reported to inhibit glycogen formation. Since it also profundly affects metabolism of potassium, an element whose concentration in liver normally parallels glycogen content, it was hypothesized that the action of DOCA on glycogen was secondary to its action on K. Male albino rats were divided into 7 groups and injected daily with 5.0 mg. of DOCA subcutaneously for 1, 2, 3, 5, 10 and 14 days respectively. Half the rats in each group received tap water and half received 1.0% KCl to drink. After a 24 hour fast, 200 mg. glucose per 100 G. was injected I. P. simultaneously with the last DOCA injection. Four hours later the animals were sacrificed and the livers and gastrocnemius muscles removed for K and glycogen determination. Administration of DOCA for 3 days or less resulted in slightly greater glycogen production, but when administered for longer periods, low tissue K and glycogen levels resulted in rats that received tap water. Tissue K levels were nearly normal, and glycogen formation only slightly inhibited in rats that received 1.0% KCl. The results indicated that the mechanism of action of

DOCA on glycogen formation was secondary to its action on potassium metabolism. (Supported in part by USPHS Grant No. A-3555).

Far Infrared Spectra of Purine and Some of its Deuterated Derivatives[1]

W. Ray Laseter and W. C. Coburn, Jr.
Southern Research Institute

As a preliminary stage in studying the far infrared spectra of substituted purines, we have prepared and recorded the spectra of several deuterated purines. The ultimate purpose of this research is to correlate the frequencies and intensities of bands in the far infrared spectra of substituted purines with physical properties of the substitutents. The positions of absorption bands in the sodium chloride region (4000 to 650 cm^{-1}) yield information as to the position and number of substitutents on aromatic rings but little as to their nature. Absorption in the cesium bromide region (650 to 285 cm^{-1}), arising from vibrations not of an isolated grouping in the molecule but from motions of all the atoms in the molecule, are much more sensitive to the nature of the substituent.

To assist us in interpretation of the spectrum of purine, itself, we began this work by substituting deuterium for the hydrogens on the purine ring. Nine deuteraetd purines have been prepared and their spectra recorded from 4000 to 285 cm^{-1}. In the cesium bromide region the spectra are characterized by two series of bands, the first between 350 and 450 cm^{-1} and the second between 550 and 650 cm^{-1}. The shifts of these bands as a function of the positions of the deuterium atoms on the purine ring will be discussed, and possible assignments proposed. The experimental techniques employed in running the cesium bromide spectra will be briefly explained.

---

[1] This work has been sponsored by the United States Air Force under Contract No. AF 49(638)-667, monitored by the Air Force Office of Scientific Research of the Air Research and Development Command.

Surface Tension of Fatty Acid Solutions as a Function of the Molecular Weight

Alan Hisey
University of Alabama

Gibbs' surface tension equation, as modified by Langmuir, in its integrated form is: $F = aRT \ln C + K$. Previous attempts in this laboratory to apply this equation to protein solutions have met with only partial success. Using data obtained from Lange's "Handbook of Chemistry" the same method of calculation has been applied to the fatty acids and some other organic compounds in aqueous solution. A close linear relationship has been found to exist between the integration constant and the molecular weight of the fatty acid. The alcohols show a similar general relationship, but with more individual variation. The slope and intercept values found for the fatty acids do not fit any of the data so far obtained for proteins. Further interpretation must await future findings.

Section III—Geology and Anthropology

A Geological Report of the Russell Cave System in Alabama

Walter B. Jones and T. W. Daniel, Jr.
Geological Survey of Alabama

Several studies by various groups of people have been made on Russell Cave located in the extreme northeast corner of Alabama near Bridgeport. These studies include a study of the biology in the cave, an archaeological excavation, and an exploration and mapping survey. This geological study was made to determine the relationship of the cave to the nearby stream and to the geologic history of the cave system and the surrounding area.

The geological processes that developed Russell Cave and the area surrounding the entrance produced ideal conditions for habitation, especially for prehistoric man. The relatively dry site entrance, the springs, and the game in the forest provided practically all his necessities including protection from intruders.

Russell Cave is one among several caves in this area on the northeast side of Montague Mountain, next to Doran Cove. The trend

of the caves is southeast parallel to Doran Cove. These trends indicate that the streams, both surface and subsurface, flow in the same direction until they empty into the Tennessee River.

It is difficult to say when a cave begins to develop and where it begins and ends. Russell Cave was probably in its initial stage during and after the Appalachian Revolution at the close of the Permian Period. After Doran Cove was developed and the streams cut through the resistant Pottsville formations to the soluble limestone beneath, the rate of cave development was relatively rapid, forming the many caves in this area.

Mineralogical Distribution and Weathering Relationships for Clayey Decatur Soils of the Limestone Valley Region of Alabama

Joe B. Dixon
Auburn University

Clay fractions were separated from selected horizons of two Decatur soil profiles and the mineralogical composition was determined by x-ray, thermal, and chemical methods. Free iron oxides increased from 2.58% in the subsoil of one profile. An increase in kaolinite with depth further indicated an accumulation of advanced weathering products in the subsoil. An increase in acidity, as evidenced by a change in pH from 5.7 in the surface soil to 4.3 in the subsoil was associated with the formation of a highly weathered subsoil. A decrease in vermiculite with increased depth also was observed. X-ray and thermal analysis data indicated appreciable deposition of aluminum between the layers of vermiculite. A small amount of illite was identified in the clay fractions of several horizons of the two soil profiles. An appreciable increase in clay with depth indicated downward movement of colloidal material.

Copper-Bearing Pyrite Deposit, Pyriton, Clay County, Alabama

Earl L. Hastings
Geological Survey of Alabama

The Pyriton pyrite deposit was mined intermittently from 1903 to 1919 as a source of sulfur for sulfuric acid manufacture. Recent studies by the U. S. Bureau of Mines (1949), the Tennessee Corpo-

ration (1954) and by the Geological Survey of Alabama in cooperation with the U. S. Bureau of Mines (1960) have revealed the character of the deposits. Seventeen drill cores, from both shallow and deep holes in the district, were analyzed and cores from the four most recently drilled holes were beneficiated to determine optimum separation characteristics of the copper-bearing pyrite ore.

From these studies it is apparent that the pyrite deposit is a regular dipping tabular orebody with pinches and swells that contain numerous discontinuous lenses of pyrite ore of variable grade. The orebody, believed to have been emplaced in shear zones in the enclosing Hillabee chlorite schist, has a pyrite content that ranges from 9 to 27%, a chalcopyrite content of about 1% and small amounts of gold.

The nearest potential market for pyrite is the Birmingham district where a demand for sulfuric acid and high grade iron oxide sinter exists.

Relation of the Geologic Structure of the Huntsville Area, Alabama, to the Occurrence of Ground Water in a Limestone Terrane

By W. J. Powell and P. E. LaMoreaux[1]

The Tennessee Valley, in the northern part of Alabama, is one of many areas in the United States underlain by massive limestone beds. These beds are the principal source of ground water for domestic, irrigation, municipal, and industrial supplies in the Tennessee Valley. Recent industrial expansion and the resulting increase in population and water use indicate the need for more effective methods to determine the occurrence and availability of water in a limestone terrane. Ground water in the Tennessee Valley, as in many other limestone areas, occurs in solutionally enlarged openings along bedding and joint planes below the water table, but a satisfactory concept of the geometry of these openings has not been developed. Nevertheless, knowledge of the relation of the regional stratigraphy and structure to the occurrence of water in limestone terranes will aid in the selection of areas for drilling successful water wells.

A study of ground-water resources in Madison County, an area of

[1] District Geologist and Chief, Ground Water Branch, U.S. Geological Survey, Tuscaloosa, Ala., and Washington, D.C.

about 803 square miles, was made in cooperation with the city of Huntsville, Madison County, and the Geological Survey of Alabama Geohydrologic conditions in this area, which is underlain by gently dipping massively bedded limestone, are characteristic of much of the limestone terrane in the Tennessee Valley. The data collected include records of 6,200 springs, water well, and oil test wells, and electric logs of more than 300 wells.

The location and alignment of wells and springs were found to be related to several aspects of topography, geologic structure, and stratigraphy as well as to the thickness of soil. The geologic structure of the area (based on the top of the Chattanooga shale) was correlated with the locations of wells of large capacity. This correlation resulted in the discovery that wells and springs having a capacity of 250 gpm (gallons per minute) or more were located in structurally low areas or along the flanks of synclines. This apparent relationship between structurally low areas and location of wells of high capacity was applied with success in the development of supplemental municipal water supplies in the Athens area, Limestone County, Ala.

Tuscaloosa Clays Guide Brown Iron Ore Exploration

Jack E. Morris
United States Pipe and Foundry Co.

The Russellville Brown Iron Ore District is located along a NE-SW trending zone, extending from the Southeastern portion of Colbert County, Alabama, to the SW corner of Franklin County.

The brown iron ore pockets are overlying the Bangor limestone formation and intimately associated with the Tuscaloosa formation.

Southwest of the city of Russellville, these pockets are covered with erratic thickness of sands and gravels which are in contact with the ores.

Three distinct areas however, each separated by normal gravel-ore relationships have been located. These areas are covered with thin "blankets" of sands, gravels, or ferruginous sandstone fragments in sandy soil. Below this "blanket," clay averaging 20 feet in thickness overlies the ore deposits.

Unfortunately, heavy flows of water are encountered at the sand-clay contact, and rapid caving of sand and gravel measures prevent the completion of many bucket holes. Holes which were completed cut clays in the following sequence: Yellow, red, blue, brown and ore zone. After several holes showed this same sequence we were able to predict the size of the ore body by drilling other holes just to the clay. If we drilled below the normal contact point without encountering the clay zone, then we knew we had unmineralized areas.

The three separate areas do not have the same clay-color relationship, but the clay is an excellent indicator in any of the three zones.

Quiet bays of the Tuscaloosa seas, far removed or cut off from the main source of otherwise rapid accumulating sands and gravels probably accounted for the deposition of clays in these areas.

Coevality of Stone and Pottery Vessels

David L. DeJarnette
University of Alabama

The extensive shell mound excavation in the Tennessee Valley of Alabama established the chronological position of stone vessels. Steatite and sandstone bowls were considered diagnostic markers for the Archaic cultural stage. Steatite vessel fragments appeared, however, on Woodland sites in other areas. Recent studies in the Weiss Reservoir Basin of Cherokee County, Alabama, indicated that the early pottery makers continued to make and use stone vessels.

Archeology, Psychology, and the Beginnings of Culture

A. T. Hansen
University of Alabama

The main point is to call attention to the possibilities of closer collaboration between experimental psychologists and archeologists in dealing with the beginnings of culture. A critical experiment is

reported which shows clearly certain limitations of chimpanzees as they solve problems. The nature of symbols and of symbolically mediated behavior is sketched. Against this background, the discussion treats the task archeologists face in deciding whether the remains of animal occupancy of a site indicate that the animals in question had culture and symbols. The suggestion is offered that psychologists might be able to learn something regarding the behavior of animals intermediate between modern *Homo sapiens* and chimpanzees by seriously examining lower Pleistocene archeological findings as if they were results of psychological experiments.

Early and Late Indian Pottery of the Mobile Bay Area

Steve B. Wimberly
Birmingham Anthropological Society

The earliest pottery in the Mobile Bay Region is fiber-tempered. The vessels of this ware are similar in form to the later Bayou La Batre-Tchefuncte series. This second complex includes scallop impressed, rocker stamped, incised, and cord-wrapped dowel impressed sherds. Deptford series wares, both check stamped and simple stamped, are also found in association with the Bayou La Batre and Tchefuncte ceramics.

Late middle Mississippian pottery exhibiting a number of decadent Moundville motifs has been isolated in the area. Pottery types found in this complex are *McIntosh Incised, Douglas Incised,* and *Three Rivers Plain.*

Early and Late Indian Pottery of the Chattahoochee Area

Edward B. Kurjack
University of Alabama

The excavation of site 1Br15 was conducted in the summer of 1959 by field crews from the University of Alabama under the direction of David L. DeJarnette. The site is located on the Alabama

side of the Chattahoochee River above Eufaula in Barbour County. A pyramidal mound is found adjacent to the site. A pottery sample totaling over seven thousand sherds was collected from a test trench in the village area.

A few stealite sherds indicate that stone vessels either slightly predate or are coeval with the small number of early fiber-tempered sherds found at the site. The first definite ceramic complex is similar to the Deptford-Cartersville Focus of Georgia; the most common method of decorating pottery during this period was check stamping. *Swift Creek Complicated Stamped* sherds of both early and late varieties are also found, but not as abundantly as the Deptford wares. Sherds of the Weeden Island Series are likewise comparatively rare. The type *Wakulla Check Stamped* seems to be absent.

Lamar pottery, characteristic of the Roods Focus, is abundant at the site; the major type is *Lake Jackson Plain. Lamar Complicated Stamped, Fort Walton Incised,* and *Lamar Bold Incised* are minority types. A historic component is the last complex at Br15 and includes the types *Ocmulgee Fields Incised, Chattahoochee Brushed,* and *Kashita Red Filmed.*

Anthropology and the USAF

Paul H. Nesbitt
Research Studies Institute, Air University

In support of target studies and to further the training of combat crews, the Air Force has conducted extensive research on the socio-economic characteristics of ethnic groups of the USSR, the Middle East, and Southeast Asia. Among other things, this research has led to the publication, on 5X8 cards, of ethnic information pertinent to the needs of Air Force crews.

Each ethnic group is described in terms of population, range, environment, physical appearance, language, religion, social organization, economy, diet, transportation, and reputation for being friendly or hostile. In addition, each card bears a photograph of a typical male and female and a map which pinpoints the location and range of the group.

To date more than 150 studies have been published. The geographical coverage has, to some degree, been dictated by Air Force operational requirements, but it is planned to continue the studies until world coverage has been achieved. Studies already completed

include 70 ethnic groups of the USSR, 40 ethnic groups of the Near East and Far East, and 40 ethnic groups of Southeast Asia.

Anthropometric and Photographic Methods

William J. Griffin and E. Carl Sensenig
University of Alabama Medical Center

The methods reviewed in this discussion are those dealing with direct skeletal measurements of human spines, and with indirect measurements using photographs of the same spines. Statistical comparison of measurements obtained from 100 human spines will be mentioned briefly.

The chief topic of discussion will be the method of taking area measurements from photographs of articular facets and joint surfaces for sex and race comparisons.

Growth in the Chimpanzee of the Pelvis and Spine

Charles W. Moulthrop and E. Carl Sensenig
University of Alabama Medical Center

This paper is concerned with certain aspects of growth changes and sex differences in the bony pelvis from six male and six female chimpanzees. Direct measurements were made from serial roentgenograms between the ages of one day to maturity at three month intervals during early development, and six month to one year intervals thereafter. Topics to be considered include growth changes, sex differences, and individual patterns and differences in pelvic development. All of the material was obtained from Yerkes Primate Laboratory, Orange Park, Florida.

Section IV—Forestry, Geography and Conservation

Measurement of Forest Fire Danger and Its Application in Fire Control

C. F. Attaway
Department of Conservation

Fire-danger is a general term expressing the sum total of both the constant and the variable factors which determine the probability of fire occurence, its rate of spread, and its resistance to control.

The idea of measuring forest fire danger originated 25 years ago in the Northern Rocky Mountains with the construction of a fire-danger rating station to measure key factors and the development of a fire-danger meter to express the degree of danger in numerical classes, based on measurement of certain fuel, weather and other factors. Considerable study of individual weather factors and their relation to inflammability preceded or accompanied the development of the first-danger rating system.

Measurements of fuel moisture and wind velocity, two or three times a day, and of rain once a day provide the data necessary to follow the development of critical conditions and obtain an accurate average daily danger rating. Current measurements of the key fire-danger factors are correlated into numerical classes or index numbers by means of a danger meter. Before the fire-danger measurement system was developed, fire control personnel tried to estimate the day's burning conditions by certain rough rules of thumb. Today they measure the amount of moisture and the wind velocity with instruments and include other important factors not considered by the old-timer.

Fire-danger ratings are useful in the prevention, presuppression and suppression phases of forest fire control and represent a tremendous advance over the rule of thumb methods used in guessing fire danger, common some twenty years ago. Fire-danger measurements and the resultant fire-danger ratings are not the answer to all fire problems. At best this information can only be a guide to judgment. However, where they have been given a fair test, their value has been thoroughly demonstrated.

Section V—Physics and Mathematics

Coincidence Scintillation Spectrometer With Photographic Recording

Richard Fearn
Auburn University

A scintillation spectrometer employing photographic recording of coincidence spectra is described and compared with other methods in current use.

The analysis of the decay of I^{128} is presented as an example of the work which may be done with the instrument.

Mathematics and Physics in the Universities of Colombia

W. L. Furman, S. J.
Spring Hill College

One year was spent in making a study of mathematics and physics in the universities of Colombia, and of the principal libraries containing materials in these fields. In nearly all of the universities in Colombia the courses in mathematics and physics are taught by engineers to students chiefly in the areas of engineering, architecture and medicine. The courses include calculus and general physics required for the professional preparation of students in these faculties. Four universities have programs for the preparation of teachers in the secondary schools. In these programs the emphasis is on subject matter content in physics and mathematics with some attention devoted to pedagogical methods. The National University of Colombia has recently organized a Department of Mathematics and a Department of Physics to teach all the courses in physics and mathematics required in the various faculties of the university and also to offer programs leading to the doctorate in mathematics and physics. This will lead to the gradual development of professional mathematicians and physicists and to research in mathematics and physics.

Meson Measurements

Victor J. Newton, S. J.
Spring Hill College

This research project consisted in an examination of the qualitative effects of nuclear particles, and specifically mesons, on photographic emulsion, and an effort at deriving quantitative relations among them from empirical data.

Examination of a particle's range in the emulsion, the grain-density of its track, and its degree of scattering, can lead to certain conclusions about the nature of the particle. This is especially true when there is observable in the emulsion a track whose nature is known, for comparative study, since these qualitative effects vary to a certain extent according to the type of emulsion.

It can very often be difficult, however, to be certain of the accuracy of the identification of individual tracks according to these qualitative effects, and a more quantitative approach may be useful. Much of this project concerned itself with determining a functional relation between the mass of the particle, the range of its track, and its mean angle of deviation, by means of which the mass of the particle could be computed from completely measurable quantities, and its identification established.

Although there was found to be a fairly large source of error in the actual measurement of the mean angle of deviation, with careful measurements and by choosing tracks that especially lent themselves to the situation, some accurate results were obtained.

Observations on X-Ray Diffraction Patterns of Egg-Shell

Charles Cain
Auburn University

1. X-Ray diffractometer traces with monochromatic copper radiation of ordinary chicken egg shell showed that the calcium carbonate occurs in the crystalline form of calcite (and not of aragonite).

2. Traces of the whole (unpowdered) shell showed the absence of certain interferences when the X-ray beam is incident on the surface under varying angles. This can be explained by preferred orientation of the crystallites, probably in a radial direction. In addition two new strong interferences were observed in the pattern of the whole shell which were absent in the trace from the powdered shell. These have not been explained yet and their disappearance upon grinding is an interesting phenomenon.

3. Laue transmission patterns of the whole shell with polychromatic radiation (molybdenum) showed a typical asterism, i. e. radially elongated Laue spots. These point to very large crystalline areas, possibly of a distorted (bent) lattice.

4. When the shell is powdered, these random Laue spots are gradually replaced (with increased grinding) by ordinary Debye Sherrer rings, the Laue spots diffusing into a general background.

Large Volume Water Cerenkov Detector

Harry Weaver
Auburn University

A large volume water filled Cerenkov detector has been con-

structed for the detection of cosmic ray particles.

The pulse spectrum has been studied, using coincidence counting techniques. A continuous monitoring of background events has been maintained with a recording.

A proposed particle detection scheme for meson study is described.

Freshman Experiments on Magnetism

L. J. Eisele, S. J.
Spring Hill College, Mobile

Two experiments are described, one a simplified form of apparatus for student measurement of the magnetic length of a bar magnet, the other a new and simplified magnetic balance for quantitative determination of the magnetic induction B between the pole faces of a magnetron magnet. Torque produced by standard balance weights is counterbalanced by current flowing in a ten turn rectangular coil. All physical constants for computing magnetic induction are readily measured by the student. Accuracy is satisfactorily high and this new experiment is designed to help the freshman college student to appreciate the various parameters associated with torque due to a current carrying coil in a magnetic field.

Ultraviolet Electroluminescence[1]

John A. Detrio
University of Alabama

The phenomenon of electroluminescence is the emission of light from phosphors stimulated by an electric field. Investigations of this phenomenon have been carried out with several commercial sulfide phosphors which luminesce in the visible. The aim of these studies is the development of a phosphor emitting efficiently in the ultraviolet. It is necessary that such a phosphor have a forbidden band gap greater than 4.9 electron volts, which increases the problems associated with obtaining conduction electrons. Several meth-

[1] These studies supported by the Army Rocket and Guided Missile Agency of the U.S. Army Ordnance Missile Command.

ods of improving presently available substances by the introduction of suitable impurities is discussed.

In the experimental arrangement used, a signal generator and amplifier provide variable voltages. A photomultiplier tube is used in conjunction with an ammeter and oscilloscope to measure emission.

Counting Atmospheric Neutrons

Edward E. Sommerfeldt, S. J.
Spring Hill College

Senior physics students at Spring Hill College have been carrying on various phases of this atmospheric-neutron-flux-determination project for the last few years. The object of the research: a reliable value of the atmsopheric neutron flux for this area. Actually, the project is probably of more significance as an introduction to research techniques.

Two main lines of inquiry suggest themselves:

1) the nature of neutrons in the atmosphere: their production by cosmic ray showers in the upper atmosphere; their energy distribution in the lower atmosphere; how the term "neutron flux" is applied to them; variations in the flux due to factors independent of the counting process, etc.

2) actual counting of atmospheric neutrons: BF_3 tubes; counters and scalers—their efficiency; background determination, final calculation of atmospheric neutron flux.

Determination of background is very difficult in this case, since the source cannot be separated from the counter, as in other experiments. Various shields were used in conjunction with cross section data. As yet, background is still high, compared to the actual count. This high count is probably due in large part to ineffective shielding of the BF_3 tube. This difficulty must be resolved before values for the flux, such as those obtained, may be accepted as definitive.

Future research: more accurate determination of background count by judicious use of shields with proper cross sections. Exact definition of energy-range of neutrons counted. Causes of background, inside and outside the counter system. Practical uses of the

flux count, e.g., relation to sun flares; possibly, also thermonuclear explosions on or near the earth.

Section VIII—Social Sciences

Credit Unions in Southern Industry

H. Ellsworth Steele
Auburn University

Although credit unions have not expanded as greatly in the South as in other sections of the country, they are growing swiftly in the region and now include more than two and one-half million members. This study seeks to determine what influence five forces have had upon the development of crdit unions in the South.

Data presented from questionnaire surveys of 390 plants in twelve southern industries and from interviews with management officials in numerous plants, bring out that managers who have had experience with credit unions are favorable to them.

Analysis of the data for the twelve industries shows that in most instances a higher percentage of those plants which are large (in terms of the particular industry) than plants which are small, use credit unions. Similarly, a higher proportion of the plants that have organized personnel departments and/or full-time personnel workers, that are unionized, or that belong to multi-unit companies than of their opposites have credit unions.

The study also reveals that there is a close relationship between the percentage of plants in any industry which have credit unions and (1) the number of employees in the median-size plant in each industry; (2) the percentage of plants which have full-time personnel workers and/or an organized personnel department; (3) the proportion of plans which are unionized; and (4) the percentage of plants which belong to multi-unit companies. More important than these factors determining whether or not a firm will have a credit union, however, may be attitudes of management and of the workers, as influenced by other considerations.

Collective Bargaining Problems of Supplemental Unemployment Benefits

Truly E. Kincey
Auburn University

Growing out of union demands for a guaranteed annual wage, a supplemental unemployment benefit program was first negotiated with Ford Motor Company in 1955 followed by similar plans in the other large automobile companies, steel, and the rubber industry. Study of the operation of the plans since that time has indicated a number of problems to be dealt with in future negotiations.

The use of a combination of reduction of hours and seniority layoff by firms may result in high seniority workers, who are the last to be laid off, receiving about the same portion of their pay for working that lower seniority men are receiving from UC and SUB while not working. Changes in layoff provisions of the contracts seem to be indicated. If the proportion of take home pay provided by UC and SUB is increased from 60-65 per cent to some higher level, it is feared that malingering among workers will increase as the level of payment rises. Provided that their income remains about the same, most people would probably prefer not to work; however, in the industries now affected malingering does not seem likely to become a serious practical problem. If it should develop into a serious problem, its burden will fall on the state unemployment compensation agencies rather than on the employers. Expansion of SUB plans into firms not covered at the present time calls for careful consideration in industries that are relatively stable and also in small firms where the ability to finance such plans varies widely.

The Henry Ford Proposal for Muscle Shoals, 1921-1924

A. G. Daniel
Florence State College

The purpose of this paper is to present a brief survey of the Henry Ford offer to develop Muscle Shoals and the Tennessee River, and the significant position this offer holds in the historical background of multiple-purpose planning for Tennessee River develop-

ment. A brief sketch of events prior and after the Ford offer is included.

During its rather turbulent history, industrialization of Muscle Shoals has undergone four defined periods of development—the formative years preceding World War I, the Wilsonian period of World War I, the spectacular Muscle Shoals controversy of the 1920's (sparked by Ford's offer), and the TVA era. Ford's offer was the last major proposal by the constituents of private enterprise to develop Muscle Shoals and the entire Tennessee River resources as one unified program. Certainly other proposals followed, but none of these encompassed as vast a program as that proposed by Ford and his associates. At the same time his offer ignited and set in motion a tremendous power struggle between the government advocates and the colonels of private enterprise for control of Muscle Shoals facilities. It is said that during the 1920's no other phase of national life received greater attention or generated a more prolonged and intense battle. Indeed, this water-power fight kept alive the Muscle Shoals problem in the halls of Congress until the coming of the Roosevelt administration in 1933.

The Emerging Role of the Sociologist

Chester W. Hartwig
Auburn University

When one stops to consider the nature of Western culture in today's world and the extent to which it at least influences the lives of most in the human family in our day, I believe it is time to pause and reflect on this human condition. If we note the importance to be attached to the scientific figure in our redefining of our physical and biological dimensions of human life, should we not raise the question as to whether or not man is going to have to confront some revolutionary redefinings of himself and his social world which arise out of the work of the social scientist?

The sociologist with his general and extensive interest in the specifically social will undoubtedly be one of the key scientific figures involved in this reorientation of man to himself and his world. Despite the difficulty of the problems involved as well as a rather

sad record of personal-social values intruding into what purports to be scientific work, it seems that the sociologist, along with other social scientific figures, cannot long persist in his protestations that he is not involved in the value-judgment process. The emerging role for the sociologist will have to incorporate, in some ways, this value—judgment involvement of the sociologist who conceives of himself as a scientific figure.

Credit Problems in Financing Homes in Rural Areas of the Southeast

J. H. Yeager[1]
Auburn University

The quality of rural housing in the Southeast is considerably below that in other areas of the United States. Although the population of most urban centers is increasing, many people choose to live in rural areas and commute to work. Rural residents are finding it difficult to finance home improvements, the purchase of existing houses or the construction of new homes.

Data for the study, carried out with funds made available under terms of an agreement with the Housing and Home Finance Agency, Washington, D. C., were obtained from a sample of 665 rural residents and 171 credit agencies in Mississippi, Alabama, Georgia, and South Carolina in 1959.

Important differences were found among major lenders in their policies and practices of making housing loans. Commercial banks characteristically made short-term loans. Life insurance companies were very selective in making loans on better residential and farm property. A relatively small percentage of home loans by life insurance companies and savings and loan associations were made in rural areas. Commercial banks preferred loans in urban areas. About half the Veterans Administration direct home loans were made in rural areas. Several governmental or quasi-governmental credit

[1]The author expresses appreciation to James R. Hurst and Boyd B. Rose for their work in compiling, tabulating, and analyzing the data for this research study.

agencies made loans to farmers. These loans were relatively few in number and low in dollar volume.

A significant difference existed in the loan-to-value ratio between urban and rural loans made by savings and loan association. Other commercial lenders reduced their appraised value on rural property. Major reason given for this practice was the lack of confidence in resale value in event of mortgage foreclosure. Interest rates were not significantly different between loans on urban and rural residential property.

Major sources of home financing available to rural residents offer conventional loans with low loan-to-value ratios and relatively short repayment periods. High down payments and high periodic payments resulting from relatively short repayment periods have prevented many rural residents from obtaining housing loans that could be justified economically based on the rural resident's repayment ability.

Alabama State Bond Ratings and the Alabama Debt Structure

Joseph M. Bonin
Auburn University

This paper reviews Moody's ratings in general, Alabama bond ratings, and the Alabama debt structure. The purpose of this analysis is to attempt to answer these questions: (1) How important are bond ratings to state financing in Alabama; (2) What are the characteristics of Alabama's debt structure that influence these ratings; and (3) What can be done to improve bond ratings and the debt structure in Alabama?

Alabama's bond ratings are not as high as they could be, but they are not as low as in some other states. Several major procedural features in Alabama's debt structure that appear to explain why Alabama has not received more Aaa and Aa ratings are: (1) the use of tax dedications; (2) the use of subordinate liens; and (3) the complexity of the debt structure. A fourth factor which apparently is not important in bond ratings but may be an important element in

determining borrowing costs is the extensive use of indirect debt.

"Must Alabama give additional specific pledges with the general pledge?" If the economic standing of a state is sound, there is no real reason it should not issue only full faith and credit debt. Alabama's performance in various economic tests suggests two things: (1) The economic ability demonstrated would support a move toward eliminating the use of specific tax dedications with future bond issues. There is no need to pledge specific taxes in addition to the full faith and credit if Alabama has such great financial ability. (2) A strong case could be made in attempting to get present ratings raised and for getting better ratings on future borrowing.

The adjustment of Alabama's debt structure to get better ratings should have two general goals: to simplify the debt structure and to increase the protection afforded to bondholders. Some of the specific steps that could help in achieving these goals are as follows: (1) eleminate or amend the constitutional debt limitation so that the State of Alabama can borrow in its own name and maximize the use of its credit; (2) forsake, constitutionally, the use of indirect borrowing—(the state should borrow for the Authorities and Agencies as they need funds); (3) discontinue, as a matter of policy, the pledging of specific taxes toward the payment of bond issues and provide, instead, that all issues may be only full faith and credit debt; (4) attempt to get bond ratings raised whenever they are warranted by presenting the case to the rating agencies; and (5) make every effort to get satisfactory provisional ratings before issues are sold.

Section IX—Medical Sciences

Edward Henry Cary

Emmett B. Carmichael
University of Alabama Medical Center

Edward Henry Cary was born in Union Springs, Alabama, on February 28, 1872. His early education was taken at a private Methodist school and then at Union Springs Academy. Young Edward obtained a position in New York City so that he could take night courses at New York University to earn necessary credits to enter

Bellevue Hospital Medical College. He enrolled as a freshman medical student in 1895 and received the M.D. degree in 1898. He remained on as an intern at Bellevue Hospital for a year and then spent two years at New York Eye and Ear Infirmary.

The death of his brother took Dr. Cary to Dallas, Texas, where he opened his office in the fall of 1901 and practiced in that city until his death in 1953. He was Professor of Ophthalmology, Baylor University School of Medicine, for 40 years and Dean from 1902-1922.

Baylor University School of Medicine moved to Houston in 1942 and Dr. Cary took an active part in establishing the Southwestern Medical College, which was accredited in 1944. And in 1949, the College became Southwestern Medical School of the University of Texas.

Dr. Cary was Prsident of the Texas State Medical Society from 1915-1916, and President of the American Medical Association 1932-1933. Baylor University conferred the LL.D. degree on Dr. Cary in 1916.

Dr. Cary was quite successful in his practice and in business ventures. He was owner of the Medical Arts Building which houses 450 doctors and dentists and has an 88-bed hospital in connection with it.

X-Ray Methods of Crystal Structure Determination

Harold E. Wilcox
Birmingham-Southern College

A review of the most important types of equipment being used to determine crystal structure will include the historically important Laue X-ray diffraction technique as well as the more modern power. Weissinberg, and precession techniques.

The evaluation of the unit cell parameters by means of these various techniques and some two- and three-dimension structure problems will be considered briefly.

In Vitro Changes in the Staining of Dental Pulp

M. B. Quigley and A. Curtis
University of Alabama Medical Center

Electron microscopy suggests that in the dental pulp collagen does not exist as polymerised fibers but as macromolecules. An at-

tempt has been made to aggregate these macromolecules using sodium chloride solutions in vitro. The unerupted teeth of young dogs were removed surgically and the pulps removed, divided into small pieces, and placed in either 1%, 2%, or 5% sodium chloride solutions for periods ranging from one hour to twenty-four hours. All the tissue was then fixed, sectioned and stained for light microscopy. While the controls showed thin-walled vessels and poorly staining extracellular material, the salt treated pulps showed a marked perivascular staining. This perivascular "cuffing" stained intensely blue with Masson's stain, and was intensely PAS positive. The altered zone around the vessels disappeared after treatment with collagenase.

A Biochemical Basis for the Resistance of Some Mouse Neoplasms to 6-Thioguanine

Patricia Stutts
Southern Research Institute, Birmingham

It has been shown that soluble enzyme preparations from L1212 leukemia cells which are resistant to 6-mercaptopurine and 8-azaguanine possessed less purine ribonucleotide pyrophosphorylase activity for catalyzing the formation of 5'-ribonucleotides of these bases than did similar enzyme preparations from the drug-sensitive parent line (Cancer Research **19**:856, 1959; **20**:643, 1960). Thioguanine-resistant Ehrlich ascites cells formed less thioguanylic acid *in vivo* and incorporated less thioguanine into nucleic acids than did sensitive cells (Sartorelli, *et al.,* Cancer Research **18**:1232, 1958; LePage, G. A., Cancer Research **20**:403, 1960).

Examination of enzyme preparations for purine ribonucleotide pyrophosphorylase activity showed that both sensitive and resistant lines of L1210 formed adenylic acid from adenine; enzyme preparations from thioguanine—and azaguanine—resistant lines (L1210/TG and L1210/8-Aza lines of L. W. Law) formed significantly less inosinic, guanylic, and thioguanylic acids from the corresponding purine bases than did similar enzyme extracts of the sensitive cell line (L1210S). Enzyme preparations from both sensitive and resistant neoplasms exhibited limited capacity for degrading natural purines and thioguanine; however, L1210S enzyme preparations formed smaller amounts of catabolic products than did enzymes from the resistant lines. In the metabolism of thioguanine by L1210/TG and

L1210/8-Asa enzyme preparations, 60-70% of the substrate was recovered unchanged. Enzyme extracts from two nonplastic tissues, liver and spleen, showed significant catabolic activity in addition to catalyzing ribonucleotide formation.

In *in vivo* studies there was a marked decrease in the incorporation of thioguanine into the nucleic acids of L1210/TG as compared to those of L1210S. Likewise, there was less thioguanine incorporation into the nucleic acids of livers of L1210/TG-bearing mice than into those L1210S-bearing animals.

It has thus been demonstrated that resistance to thioguanine in the L1210 neoplasms studied is accompanied by decreased activity of the pyrophosphorylase which catalyzes the formation of guanylic and thioguanylic acids. This diminished pyrophosphorylase activity was correlated with markedly less incorporation of thioguanine into nucleic acids of L1210/TG.

Carcinogenic Activity of Nucleic Acid Extracts from Neoplastic Cells

Bettie A. Duncan, G. J. Dixon, and F. M. Schabel, Jr.
Southern Research Institute, Birmingham

The studies of Lacour, *et al,* in which they suggested that nucleic acids from human leukemic tissue possessed carcinogenic activity, prompted the investigation of nucleic acids from human tumor cells *in vitro*. Following the phenol extraction procedure of Gierer and Schramm, nucleic acid fractions were recovered from three continuous passage cell lines and animal neoplasms. Normal human and animal tissue extracts were employed as controls. Phenol extracts of normal and neoplastic tissues were injected into new-born mice. During the following nine-month observation period, 9.4% of the 246 treated animals developed tumors generally at the site of injection; whereas animals injected with nucleic acids from normal tissues developed no tumors. The control animal data, coupled with independent observations from another laboratory, gave a spontaneous tumor incidence of 1.6%. Chi-square analysis of the data revealed that the figure for tumor incidence with the phenol extracts was significant beyond the 99.9% confidence level. The results suggest that nucleic acids from neoplastic human cells grown *in vitro* and from certain animal neoplasms are capable of altering the gene-

tic make-up of cells when injected into infant mice. (Supported by NIH Contract SA-43-ph-1907).

Organization of Cardiogenic Capacity

Lowell M. Duffey
University of Alabama Medical Center

Parasagittal incisions of streak and headprocess stage chick embryos result in fragments distinctive in the degree of cardiogenic capacity when cultured *in vitro*. Within 25 hours culture, fragments bearing node and streak (Type I) developed pulsatile hearts in 65%, 70%, 89% and 94% of cases from Hamburger-Hamilton stages 4-, 4, 5 and 6, respectively. In contrast, fragments lacking node and streak (Type II) developed pulsatile hearts in 12%, 36%, 91% and 94% of cases employing the same stages and culture period. Hearts formed in streak-stage Type II fragments were very small relative to hearts formed in Type I fragments from the same stage of development.

Analyses of relative cardiogenic deficiency in Type II fragments from streak-stage embryos show that left fragments are less deficient than right ones and that fragments from late-streak embryos are less deficient than fragments from early and mid-streak stages. Regardless of these differences, Type I and Type II fragments differ significantly and consistently in cardiogenic capacity. Recognition of the possibility that differentiation of cardiogenic mesoblast may require some factor(s) emanating from the node and streak led to grafting node fragments into Type II fragments. In 50 cases of successful graft incorporation, 100% heart formation and pulsation within 25 hours culture obtained. In 92% of the 50 cases, the size of the heart was comparable to hearts developing in Type I fragments.

Synergistic Inhibition of Bacteria by Combinations of Actinobolin and Certain Purine Analogues

Robert F. Pittillo and Barbara G. Quinnelly
Southern Research Institute, Birmingham

Actinobolin, a broad spectrum antitumor and antibacterial antibiotic, has been reported to be a much less effective inhibitor of

Streptococcus faecalis and *Escherichia coli* when these bacteria are cultured in the presence of certain purines. This observation implies that actinobolin may be an inhibitor of purine biosynthesis or utilization, and hence its activity may be enhanced by analogues of purine precursors, purines, nucleosides or nucleotides. In a series of bacterial inhibition studies this possibility was investigated. Some purine analogues, notably 6-mercaptopurine, were found to inhibit bacteria synergistically with actinobolin. The potential value of studies of this nature in the field of cancer chemotherapy will be discussed.

Glycogen Content of Thyroid Tissues

W. E. Martindale, J. A. Pittman, Jr., and W. J. Wingo
University of Alabama Medical Center

Glycogen content of beef and human thyroid was measured in 50 to 400 mg. slices using the method of Hanson, Schwartz and Barker (Amer. J. Physiol., 198:800 (1960). Glycogen was determined on the ethanol precipitable fraction. Studies were also made on bovine tissue slices of the 50 to 100 mg. weight range incubated at 37°C in Krebs-Ringer bicarbonate solution for varying times in the presence and absence of thyroid stimulating harmone (TSH), and epinephrine. Fetal calf thyroid tissue was similarly studied. On a wet weight basis the fetal tissue had both the highest total carbohydrate and glycogen contents. The incubated tissues showed little change in glycogen levels. The total carbohydrate content of the TSH treated slices from the mature animals, however, was lower than that found in the controls.

Effects of Section of the Spinal Dorsal Roots in Cats

H. H. Hoffman and E. G. Hamel, Jr.
University of Alabama Medical Center

Section of the dorsal roots in the lumbosacral region produces extensor rigidity in the ipsilateral extremity (Ranson). Section of roots in the lower cervical region produces extensor rigidity in both ipsilateral extremities (Kaelber-personal communication). In an

effort to exclude cord damage as the causative factor in this rigidity, the dorsal roots have been sectioned in the thoracic region. Roots T3 to T7 or T8 were sectioned unilaterally and the cats allowed to survive 1 to 3 months. No extensor rigidity comparable to that seen after cervical root section has been demonstrated, even though some animals show other evidence of cord injury. As the dorsal radicular arteries were interrupted with these roots, it would seem that this loss does not significantly impair cord function. The lack of this rigidity in primates after section of the roots to the brachial plexus (Lassek) gives the impression that such rigidity in cats is an expression of the influence of descending spinal cord pathways.

The Influence of Ovarian Hormones on Hamster Submaxillary Mucin

John M. Shackleford and C. E. Klapper
University of Alabama Medical Center

A sex dimorhphism is evident in hamster submaxillary glands after staining with alcian blue. Sialic acid determinations reveal a significant difference in the concentration as well as the total amount of this acidic carbohydrate in the male and female In all cases the sialic acid content of the female hamster submaxillary gland is greater, and the alcian blue staining more intense, than in the male. Ovariectomy reduces the sialic acid content of the female submaxillary gland while estradiol administration in the male elevates the sialic acid to a level comparable with the normal female. Acian blue preparations consistently correspond to the concentration of sialic acid in homogenates made from the contralateral gland. Intense staining of the submaxillary gland acini is demonstrated in the normal female and in the estradiol treated male. Conversely, the normal male and ovariectomized female submaxillary glands show only a faint reaction with alcian blue. These data are presented as evidence that certain of the female sex hormones influence the synthesis and/or the incorporation of sialic acid into hamster submaxillary mucin. (Supported by NIH Grant No. 706.)

ARTICLES

Peanut Storage Studies

Chemical Changes During 8 Years of Storage[1]

N. D. Davis
Auburn University

Chemical analyses of Dixie Runner peanuts, stored 1 to 8 years, were made to determine the extent of chemical change that might be expected to occur as a result of prolonged storage on the farm under fluctuating environmental conditions in farm-type storage bins.

Materials and Methods

Peanuts were harvested in the vicinity of the Wiregrass Substation, Headland, Alabama, field-cured, and stored in 4- to 6-ton capacity farm-type storage bins until 1957. From 1957 to 1959 the samples were stored in burlap bags in a barn at Auburn, Alabama. The initial composition of each years sample was not determined. However, for a basis of comparison, results of more than 40 analyses of this variety, grown during the last 15 years in the same locality, were averaged and reported as average initial composition of the variety (Tables 1, 2). Differences from this five year average were regarded as changes during storage, when the magnitude of differences from the "average" was consistently greater in samples of increasing age, i.e. when the magnitude of difference varied directly as the age of the samples.

Three independent series of analyses were made on each of three different samples from each year's crop and results averaged. Total oil was determined according to the American Oil Chemist's Society (1) method AB 3-49 and free fatty acids by AOCS method Ab 5-49. Analyses of nitrogen fractions were by the Kirk Micro Kjeldahl method (4), peroxides by the Wheeler method as modified by Moore and Beckford (5), carbonyls by the Henick method (2), carboxylic acids by the method of Resnik *et al.* (7), tocopherols by the method of Hove and Hove (3), and total sugars by the method of Pelczar *et al.* (6). Germination tests were on 100-seed samples, using a Da-Light seed germinator.

The taste test, devised by this laboratory, was an attempt to measure the palatability of each sample (Table 2). Peanuts were

[1] Release of this report for publication is granted by the Director of Auburn University Agricultural Experiment Station.

shelled and roasted for 20 minutes at 140°C in a forced-air oven, assigned a code number, and presented to a panel of 5 or more people. Samples were tasted and graded on a relative basis of 1 to 5 points as follows: 5 points—excellent, 4 points—good, 3 points—fair, 2 points—flat, 1 point—unpleasant. Results are listed in the form of an index representing the total number of points received for each sample divided by the number of people participating in the test.

Prior to analyses the peanuts were shelled, oven dried to constant weight in a forced-air oven (130°C for approximately 1 hour) and ground to a fine consistency with a Universal No. 71 food grinder. Analyses of the oil were made immediately following preparation of the samples. Samples were stored at 0°C in screw-capped bottles and the remaining analyses made shortly thereafter.

Results and Discussions

Results indicated that a slow consistent change of some components of the peanut occurred during the storage period of 1 to 8 years. Other components were relatively stable during prolonged periods. Total oil (Table 1) was 48 to 49% kernel dry wt. in 1 to 7 year-old samples. The oil appeared to be very stable with substantial degradation occurring only after 7 years of stor-

TABLE 1. Changes in chemical constituents of peanuts during 1-8 years of storage.

Years in Storage	Moisture % kernel dry wt.	Oil content % kernel dry wt.	Peroxide value	Carbonyl compounds mM/kg. oil	F.F.A. as % T.F.A.
Initial composition					
(5-year average)	—	48.0	2.5	0.45	0.30
1	6.4	49.1	1.5	0.73	0.30
2	5.9	49.3	2.7	0.77	0.38
4	6.5	49.1	1.5	0.78	0.48
5	5.8	48.7	2.3	0.92	0.85
6	6.1	48.3	2.8	1.05	1.20
7	5.8	48.0	2.0	1.18	1.20
8	4.0	45.0	6.0	1.35	2.30

TABLE 2. CHANGES IN CHEMICAL CONSTITUENTS OF PEANUTS DURING 1-8 YEARS OF STORAGE.

Years in Storage	Carboxylic acids m. eq./g.	Total sugars mg./g.	Total nitrogen % kernel dry wt.	Protein nitrogen % kernel dry wt.	Taste test index*	Germination test % 100 seed
Initial composition						
(5-year average)	0.7	28.4	4.4	3.8	—	—
1	1.7	28.5	4.4	3.9	3.6	80
2	1.8	28.1	3.8	3.3	3.7	90
4	1.7	27.6	3.9	3.5	2.7	3
5	1.9	26.8	3.8	3.5	2.2	0
6	2.1	29.3	3.7	3.6	2.1	0
7	2.6	29.3	3.8	3.4	1.6	0
8	2.8	29.0	3.8	3.4	1.0	0

* Sale was from 1 to 5. 1 = bitter, 5 = excellent.

age. The 8 year-old samples averaged 45% oil. Free fatty acids (Table 1), increased slowly throughout storage, an index of developing hydrolytic rancidity. Values ranged from 0.30% of total fatty acids in 1 year-old seed to 2.3% in 8 year-old seed. Total sugars (Table 2) did not change greatly through time, but averaged 28 to 29 mg./g. of peanut in all samples. Peroxide value and carbonyl content (Table 1) varied with storage time and are regarded to be indices of developing oxidative rancidity. Carbonyl content increased from 0.73 mM/kg. oil in 1 year-old samples to 1.35 in 8 year-old samples. This compares to an average initial value of 0.45 mM/kg. Total nitrogen decreased slightly during storage, as did protein nitrogen. In general the nitrogen fraction was stable with respect to storage time, decreasing less than 0.5%.

Carboxylic acids varied directly with storage time. Initial acid content was 0.7 m.eq./g. of peanut. One year old kernels averaged 1.7 m.eq./g. and 8 year-old kernels 2.8 m.eq./g.

Taste-test results (Table 2) showed that palatability decreased with storage time, except that the 1958 peanuts were judged to be slightly more palatable than the 1959 peanuts. Differences in initial quality are thought to be responsible for the closeness in rating of the two samples. Growers generally agreed that the 1959 crop was inferior in initial quality to that of 1958. One and two year-old kernels were described as tasty, 8 year-old kernels as bitter, and all other samples described as flat but not inedible.

The germination tests with 100-seed samples showed that only the 1 and 2 year-old seed were appreciably viable (Table 2). Samples were not available for 3 year-old seed. Only 3% of the 4 year-old seed germinated. Viability differences between 1958 and 1959 seed are again attributed to differences in initial quality.

LITERATURE CITED

1. American Oil Chemist's Society, Official and Tentative Methods, rev. to 1959.
2. Henick, A. S., Benca, M. F., and Mitchell, J. H., Jr., J. Am. Oil Chemists' Soc., 31, 88-91 (1954).
3. Hove, E. L., and Hove. Z., J. Biol. Chem., 156, 601-610 (1944).
4. Kirk, P. L., IND. Eng. Chem. Anal. Ed., 8, 223-224 (1936).
5. Moore, R. N., and Bickford, W. G., J. Am. Oil Chemists' Soc., 29, 1-4 (1952).
6. Pelczar, M. J., Hansen, P. A., and Konetzka, W. A., Quantitative Bacterial Physiology Laboratory Experiments, 109-111 (1955). Burgess Publ. Co., Minneapolis, Minn.
7. Resnik, F. E., Lee, L. A., and Powell, W. A., Anal. Chem. 27, 928-931 (1955).

Supplementary Note on the History of Malaria

Roland M. Harper
University, Alabama

In a talk on the history of malaria, presented at our 1960 meeting, I noted that the word malaria did not appear in the mortality statistics of the U.S. census of 1850, though the dictionaries trace it back to 1740.

Since then I have come across an American use of the term before 1850, which seems worth putting on record, as it also illustrates the prevailing views at that time on the cause of malaria, even among highly educated persons.

Charles Lyell (1797-1875), an eminent British geologist, made two lengthy visits to the United States, in 1841-2 and 1845-6, and travelled in most of the states. He was a keen observer of many other things besides geological phenomena and published his observations in two books of two volumes each, in London and New York simultaneously, in 1845 and 1849. The American editions at least seem to be still pretty well represented in our libraries. The two editions seem to be identical in wording but not in pagination; so I will cite chapters instead of pages.

In January, 1842, Mr. Lyell (later Sir Charles Lyell) was near Stony Bluff on the Savannah River, in Screven County, Georgia. And in Chapter 8 of the first volume of his "Travels in North America" (1845), he says:

"After making a collection of specimens, I walked about the wood, and found a lone house, at the door of which a woman was sitting, in a languid state of health. She said she had just recovered from the fever, or chill; and among other inquiries, asked when we had last had this complaint. On being told we had never had it, she said, 'I should like to live in your country, for among the Whites there is not one in this section of Georgia that has escaped.' It is true, that consumption, so common in the Northern states, and so often fatal, is unknown here; but the universality of the ague makes these low districts in the Southern states most unenviable dwelling places. The best season for a geological tour in this part of Georgia and South Carolina, east of the mountains, is from December to April inclusive."

Later in the same month Lyell was on the Cooper River in

lower South Carolina, and in Chapter 9 of the same work he said: "In summer . . . the planters are compelled by the fever and ague to abandon their country seats. It was not so formerly. When the English army was campaigning on the Cooper and Santee rivers in the revolutionary war, they encamped with impunity in places where it would now be death to remain for a few days in the hot season. I inquired what could have caused so great a change, and found the phenomenon as much a matter of controversy as the origin of the malaria in Italy. The clearing away of the wood from large spaces is the chief alteration in the physical condition of this region in the course of the last sixty years, whereby the damp and swampy grounds undergo annually the process of being dried up by a burning sun. Marshes which are overflowed by the tide twice in every twenty-four hours near the neighbouring coast, both in South Carolina and Georgia, are perfectly healthy. Dr. Arnold remarks, in his Roman History, that Rome was more healthy before the drainage of the Campagna, and when there was more natural wood in Italy and in northern Europe generally. In the Southern States of the Union there are no fevers in winter, at a season when there is no large extent of damp and boggy soil exposed to a hot sun, and undergoing desiccation."

It is perhaps worth noting that Lyell did not definitely identify the "fever and ague" in the United States with the malaria in Italy; but that would be the reader's impression. A possible reason why malaria was more prevalent in South Carolina in his time than during the Revolution may be that at the earlier period the malaria germ simply had not reached there; as suggested by a note on its progress across Connecticut, in my previous paper.

A Note on Hepatic Cysticercosis, with the Proposal of a New Variety of Taenia Saginata

Emmett W. Price
Jacksonville State College*

The customary locations of *Cysticercus bovis*, the larval stage of the so-called beef tapeworm, *Taenia saginata*, of man are the masseter and other skeletal muscles, tongue, heart and diaphragm. On rare occasions from one to a few cysticerci may be found in the liver but massive infections of this organ are apparently very unusual. Recently Ginsberg and Grieve (1959) reported two cases of hepatic cysticercosis in bovines in Kenya; these were described as follows:

"The liver of a 4½-year-old steer was found to be densely studded throughout the whole parenchyma with cysts. A meticulous search for cysts in the skeletal muscles and organs proved negative. On microsopical examination the liver cysts were found to be those of *C. bovis*. Early evagination of the scolex occurred on viability test. In all, 1,836 cysts were counted in the infected liver."

"The second case was a 4-year-old steer. Numerous cysts resembling those of *C. bovis* were noticed under the liver capsule, but none in the deeper layers of the parenchyma. A thorough examination of skeletal muscles and organs did not reveal any further cysts. Microscopical examination confirmed *C. bovis* and a viability test their activity. In all 44 cysts were counted in the liver."

So far as the writer is aware no comparable cases have been reported under natural conditions in the United States.

Hepatic cysticercosis in giraffes

In 1927, the Emperor of Abassynia (now Ethiopia) presented to the late President Calvin Coolidge two young giraffes. These were placed, as is customary for gifts of wild animals, in the National Zoological Park, Washington, D.C.

On November 26, 1927, one of the giraffes died and a necropsy was performed by the writer. Numerous unarmed cysticerci were found in the liver but not elsewhere in the carcass. Some of the

* The observations reported herein were made while a member of the staff of the former Zoological Division, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D.C.

cysts were administered by Dr. Benjamin Schwartz to two dogs and a cat. On examination postmortem two weeks later these animals were found to be uninfected (Schwartz, 1926).

The second giraffe died February 2, 1928, and was necropsied on February 5. Numerous cysticerci indistinguishable from *Cysticercus bovis* were found scattered throughout the liver parenchyma; none was found elsewhere in the body.

Experimental infection of man

In order to be certain that the cysticerci from the giraffe were those of a tapeworm of man, three of the cysts from the second giraffe were placed in a gelatin capsule and swallowed.

Gravid proglottids were first passed on April 22 and continued to be passed almost daily, in numbers varying from 3 to 50, until May 31 when the infection was terminated. On May 7, a portion of a tapeworm 51½ inches long was passed spontaneously; this portion consisted of mature, semigravid and gravid proglottids. The fact that gravid proglottids continued to be passed daily thereafter proved conclusively that more than one tapeworm had developed from the cysts swallowed February 5.

The medicament used to terminate the infection was carbon tetrachloride in a dose of 2.7 ml administered in a gelatin capsule, preceded and followed by a saline purgative. Inasmuch as purgation following the administration of the dose of carbon tetrachloride was delayed for five hours, the tapeworm or tapeworms passed consisted of a mass of partially digested segments. Since no subsequent proglottids were passed, the treatment was obviously successful.

Experimental infections of animals

On May 8, 1928, about 2 ml of a moderately heavy saline suspension of eggs, obtained from gravid proglottids collected on the previous day, were given to each of two 3-month-old calves (Nos. 1431 and 1426), two pigs and a sheep.

On August 20, calf 1431 was slaughtered and examined for tapeworm cysts. The liver was filled with an undetermined number of viable cysts; the lungs contained many degenerated and a few viable cysts; the heart, diaphragm and masseter muscles were moderately infested; a few cysts were present in the kidneys; and one was found in the esophagus.

On October 31, calf 1426 was slaughtered and numerous degenerated cysts were present in the liver; a few degenerated cysts

were found in the lungs and masseter muscles.

The pigs and sheep were slaughtered on September 11. No evidence of infection was found in the pigs, but in the sheep numerous aborted cysts were present in the liver and a single mature cysticercus was found between the diaphragm and spleen.

Discussion

In view of the failure to secure a complete specimen of the mature tapeworm developing from the ingested giraffe cysticerci, it was not possible to make an adequate comparison with the unarmed tapeworms originating from bovine muscle cysticerci.

The size and structure of the larval forms from the giraffe, as well as the gravid proglottids and eggs obtained from the experimental infection, differed in no essential respects from those of *Taenia saginata.* The mature proglottids (Fig. 1), however, presented some differences from those described and figured by different investigators for the beef tapeworm. These differences were in shape—about 3 times as wide as long instead of almost square; genital aperture in middle of lateral margin instead of posterior to middle; cirrus pouch not extending mediad as far as the lateral excretory canal; and fewer testes in uterine field. Whether these differences are significent cannot be determined until the extent of individual variation occurring in specimens of mature tapeworms developing from muscle cysticerci can be compared with those derived from liver bladderworms.

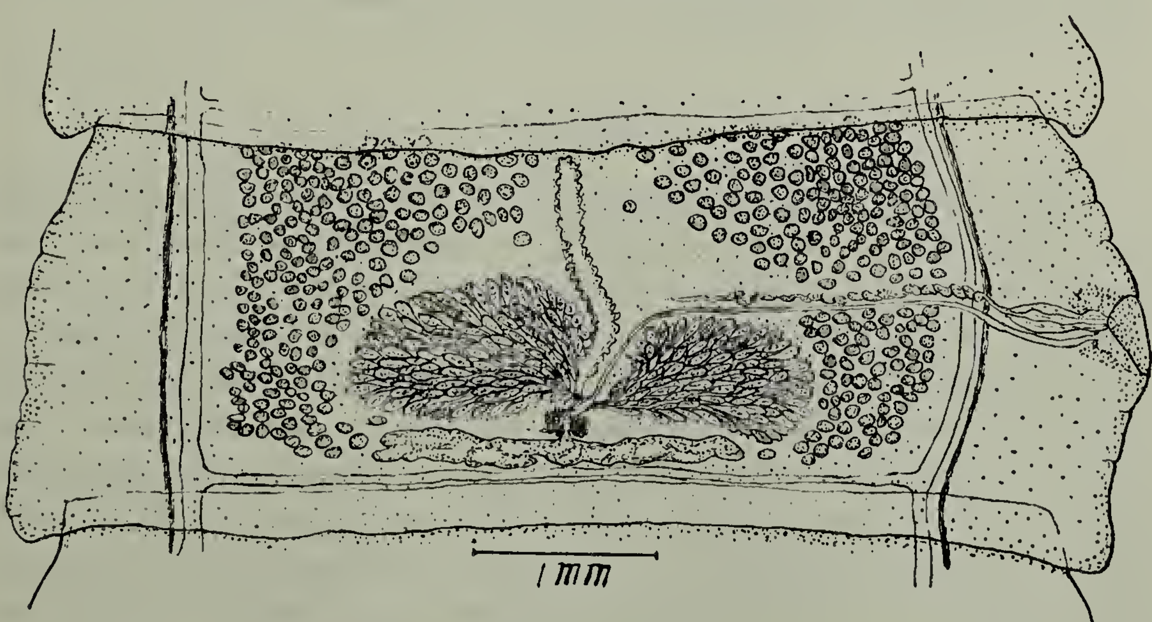


Figure 1. Mature proglottid of tapeworm developing from human infection with cysticercus from giraffe.

From the standpoint of shape of the mature proglottids, the possibility that the worm reported herein may be the same as that described by von Linstow (1900) as *Taenia africana* cannot be overlooked. This worm was collected from a colored soldier at Langenburg, near Lake Nyasa, Tanganyika. Aside from the segments being wider than long, the internal morphology, especially of the ovary, seems to preclude the possibility of the two forms being identical. On the other hand, the figures are somewhat diagrammatic and were drawn from frontal sections, and the possibility of error in interpretation cannot be excluded.

It may be noted that so far the reported cases of massive cysticercosis of the liver of ruminants have all been from African hosts, notably, the cases reported by Ginsberg and Grieve (*loc. cic.*) and the ones reported herein. Liver cysticercosis of giraffes has also been recorded by von Linstow (1878)—based on material reported in 1863 by Weinland—and by Mobius (1871). No details on the intensity of these infections are available to the writer.

The differences in organization of the mature proglottids, while admittedly slight, together with the fact that the liver seems to be the site of predilection for the development of the cysticercus or larval stage of the giraffe tapeworm, as demonstrated by experimental infections reported herein, seem to warrant this tapeworm being regarded as a variety of *T. saginata.* Accordingly, the name *Taenia saginata* var. *giraffae* n. var. is proposed for it.

Summary

Two cases of heavy infestations of the liver of giraffes with the cysticercus or larval stage of a tapeworm of man are discussed. A human infection with the adult tapeworm resulting from ingestion of cysticerci from one of these cases is reported, demonstrating beyond question that the giraffe infections were of human origin. Experimental infections of two calves demonstrated that the liver was the favored site for the development of the cysticerci. On this basis, together with slight morphological differences of the mature proglottids, the tapeworm developing from the giraffe cysticerci is provisionally regarded as a variety of the unarmed Taenia of man for which the name *Taenia saginata* var. *giraffae* is proposed.

LITERATURE CITED

Ginsberg, A. and Grieve, I. M.

1959.—Two unusual cases of liver cysticercosis. Vet. Rec., 71:618.

von Linstow, O. F. B.

1878.—Compendium der Helminthologie. xxii + 382 pp. Hannover.

1900.—*Taenia africana* n. sp., eine neue Tanie des Menschen aus Afrika. Centralb. Bakteriol. 1 Abt., 28:485-490.

Mobius, Karl A.

1871.—Beobachtung der Finne der *Taenia mediocanellata* Kuchm. in einer Giraffe. Zool. Garten, 12:168-170.

Schwartz, Benjamin.

1928.—Occurrence of Taenia in the liver of the giraffe. Jour. Parasitol., 15:67.

Synthesis of Potential Anticancer Agents
Fraudulent Nucleotides Derived from 6-Mercaptopurine

H. Jeanette Thomas and John A. Montgomery
Southern Research Institute, Birmingham, Ala.

The two important anticancer agents, 6-mercaptopurine [purine-6(1*H*)-thione] and 8-azaguanine [5-amino-*v*-triazolo[4, 5-*d*] pyrimidin-7(6*H*)-one] must be converted to their respective ribonucleotides in order to inhibit the growth of neoplasms susceptible to their action. It has been found that neoplesms resistant to the action of these two compounds do not have the pyrophosphorylase necessary to carry out this conversion.[1, 2] The ribonucleotides of 6-mercaptopurine and 8-azaguanine were prepared in an effort to circumvent this problem of resistance.[3]

Since it is now known that the nucleotides of the naturally occurring purines are poorly incorporated into cell nucleic acids[4] and that they are not incorporated intact[5, 6], serious doubts arise that nucleotides, as such, can penetrate the cell membrane. The possibility of overcoming this difficulty by using an ester of a nucleotide which could penetrate the cell wall and then be metabolized to the free nucleotide presented itself. Some simple esters of 6-mercaptopurine ribonucleotide, namely the diphenyl, dibutyl, and diethyl esters, were therefore prepared.[7] Our work has now been extended to the preparation of more complex esters of this compound.

Bis (9-beta-D-ribofuranosylpurine-6(1*H*)-thione) 5', 5''-phosphate (VI) was prepared by two different methods. Both methods required the conversion of 6-mercaptopurine ribonucleoside to its 2', 3'-*O*-isopropylidene derivative (I), thus blocking the 2', 3'-*cis*-hydroxyls of the ribose moity to prevent reaction at these positions. This was accomplished by stirring a suspension of 6-mercaptopurine ribonucleoside in acetone at room temperature for four hours in the presence of copper sulfate and ethane sulfonic acid.

Reaction of 9-(2', 3'-*O*-isopropylidene-b e t a-D-ribofuranosyl) purine-6-(1*H*)-thione (I) with *p*-nitrophnyl phosphorodichloridate[8] by the method of Razzell and Khorana[9] gave bis [9-(2',3'-*O*-isopropylidene-beta-D-ribofuranosyl)purine-6-(1*H*)-thione] 5', 5''-*p*-nitrophenyl) phosphate (III). Acid hydrolysis of the isopropylidene

blocking groups and subsequent removal of the *p*-nitrophenyl group with base gave the desired product (VI). The analytical sample was obtained by passing a solution of the crude product through a column of Dowex 1 (X-2) (formate) ion exchange resin.

The alternative method for the preparation of this compound (VI) involved the preparation of the isopropylidene derivative of 6-mercaptopurine ribonucleotide (II), since again it was necessary to have the 2', and 3' hydroxyls of the ribose moiety blocked in order to prevent their reaction. This was carried out by the same procedure used to prepare 6-mercaptopurine ribonucleotide,[3] except that the step involving the removal of the isopropylidene blocking group was omitted. This procedure involved the reaction of a pyridine solution of I with 2-cyanoethyl phosphate in the presence of dicyclohexylcarbodiimide (DCC), followed by removal of the 2-cyanoethyl group with base. The product was purified by isolation as its barium salt. The free nucleotide was then obtained by stirring an aqueous solution of the salt with Amberlite IR-120(H) ion exchange resin. The free nucleotide (II) was then allowed to react with I in pyridine containing DCC. The product, bis[9-(2', 3'-*O*-isopropylidene-beta-D-ribofuranosyl)purine-6(1*H*)-thione] 5', 5"-phosphate (IV) was thus obtained. The isopropylidene blocking groups were removed with acid. This product (VI) was also purified by passing it through a column of Dowex 1 (X-2) (formate) resin. It was found by paper chromatograms and its ultraviolet spectra to be identical to the product obtained from the first procedure. However, the second method was inferior to the first because the yields were lower and the steps of the reaction were more time consuming.

Another ester of 6-mercaptopurine ribonucleotide prepared was thymidylyl-(5', 5")-9-beta-D-ribofuranosylpurine-6-(1*H*)-thione phosphate (X). In order to prepare this compound, it was first necessary to block the 3-hydroxyl of the deoxyribose moiety of thymidylic acid[10] to prevent its reaction. This was accomplished by the method of Gilham and Khorana.[11] The pyridinium salt of thymidylic acid was prepared by passing its calcium salt (VII) through a column of Amberlite IR-120 (pyridinium) ion exchange resin. It was then reacted at room temperature with acetic anhydride to give the desired 3'-*O*-acetylthymidylic-5'-acid (VIII). This compound was then reacted with I and DCC in pyridine. The product obtained was 3'-*O*-acetylthymidylic (5',5")-9-(2',3'-*O*-isopropylidene-beta-D-ribofuranosyl)purine-6(1*H*)-thione phosphate (IX). The

acetyl group was removed with base, and the subsequent acid hydrolysis of the isopropylidene group gave the final product (X), which was purified by passing it through a column of Dowex 1 (X-2) (formate) resin.

REFERENCES

1. R. W. Brockman, C. S. Sparks, D. J. Hutchison, and H. E. Skipper, *Cancer Research*, **19**, 177 (1959).
2. R. W. Brockman, L. L. Bennett, Jr., M. S. Simpson, A. R. Wilson, J. R. Thompson, and H. E. Skipper, *Cancer Research*, **19**, 856 (1959).
3. John A. Montgomery and H. Jeanette Thomas, *J. Org. Chem.* **26**, 1926 (1961).
4. L. L. Bennett, Jr., H. E. Skipper, D. Smithers, and E. H. Hayes, *Cancer Research*, **19**, 217 (1959).
5. P. M. Roll, H. Weinfeld, E. Carroll, and G. B. Brown, *J. Biol. Chem.*, **220**, 439 (1956).
6. H. Weinfeld, P. M. Roll, E. Carroll, G. B. Brown, and C. P. Rhoads, *Cancer Research*, **17**, 122 (1957).
7. John A. Montgomery, H. Jeanette Thomas, and Howard J. Schaeffer, *J. Org. Chem.*, **26**, 000 (1961).
8. A. F. Turner and H. G. Khorana, *J. Am. Chem. Soc.*, **81**, 4647 (1959).
9. W. E. Razzell and H. G. Khorana, *J. Biol. Chem.*, **234**, 2105 (1959).
10. Schwarz Laboratories.
11. P. T. Gilham and H. G. Khorana, *J. Am. Chem. Soc.*, **80**, 6218 (1958).

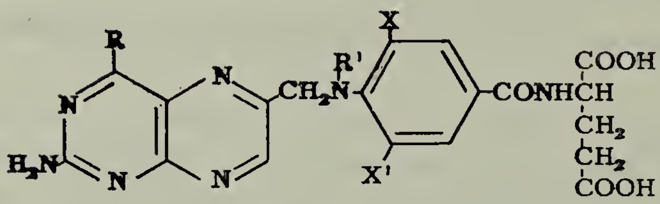
The Synthesis of 3'-Fluoropteroylglutamic Acid

James R. Piper, K. Hewson, and John A. Montgomery
Southern Research Institute, Birmingham, Alabama

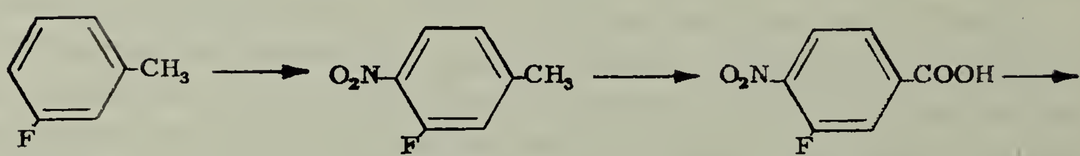
Recent interest in 3'-halo (I) and 3', 5'-dihalo (II) derivatives of amethopterin as folic acid antagonists with enhanced anticancer activity over that of unsubstituted amethopterin (III) has prompted us to study the preparation of fluoro derivatives of this type. The anticancer activity of the compounds that have been tested is apparently enhanced by the halo substituents *ortho* to the amino group that is involved in one-carbon metabolism. It appears that the fluoro compounds corresponding to the previously studied halo compounds might exhibit even better activity.

Most of the halo derivatives of this type previously prepared by other investigators were obtained by direct halogenation of amethopterin and pteroylglutamic acid (PGA) (IV). Although this procedure cannot be applied to the preparation of fluoro compounds, M. Sletzinger and co-workers [*J. Am. Chem. Soc.*, 77, 6365 (1955)] have described an elegant synthesis of PGA that appears to have general application. This synthesis involves the preparation of 2-acetamido-4-hydroxy-6-formylpteridine and its subsequent condensation with *p*-aminobenzoylglutamic acid in the presence of *p*-toluenethiol as a reducing agent. The product, N^2-acetylpteroylglutamic acid, is readily deacetylated to give pure PGA.

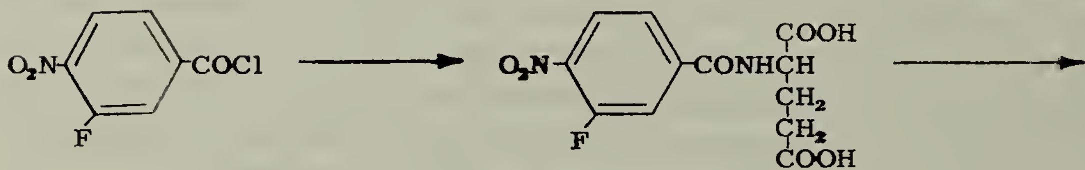
We have successfully applied this approach in an initial small-scale preparation of 3'-fluoropteroylglutamic acid (V). Nitration of *m*-fluorotoluene (VI) (Pierce Chemical Co.) gave, along with 5-fluoro-2-nitrotoluene, 3-fluoro-4-nitrotoluene (VII). Side chain oxidation of VII, followed by treatment with thionyl chloride, gave 3-fluoro-4-nitrobenzoyl chloride (IX), which was condensed with glutamic acid under Schotten-Baumann conditions to give 3-fluoro-4-nitrobenzoylglutamic acid (X). Catalytic reduction of X gave 4-amino-3-fluoro-benzoylglutamic acid (XI). Condensation of XI with 2-acetamido-4-hydroxy-6-formylpteridine in the presence of *p*-toluenethiol under the conditions described by Sletzinger and co-workers (*loc. cit.*) gave N^2-acetyl-3'-fluoropteroylglutamic acid (XII). Removal of the N^2-acetyl group by mild basic hydrolysis afforded 3'-fluoropteroylglutamic acid (V).



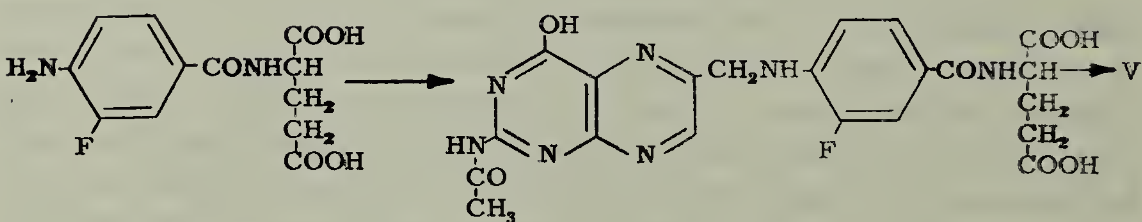
I R=NH_2, R'=CH_3, X=H, X'=Cl or Br
II R=NH_2, R'=CH_3, X=X'=Cl or Br
III R=NH_2, R'=CH_3, X=X'=H
IV R=OH, R'=X=X'=H
V R=OH, R'=X=H, X'=F



VI VII VIII



IX X



XI XII

Weathering of Alabama Mica Quartz Feldspar Pegmatites

Hugh D. Pallister

Geological Survey of Alabama

University, Alabama

During my years of mining and geologic study of mica pegmatites,[1] particularly during World War II, in Alabama, both in the surface prospects, as well as in the underground mica mines, I have had occasion to observe the action of weathering which has resulted in many interesting effects. Commercially, of course, the mica which was free of blemishes and other defects brought a much higher price than did the inferior mica.

In considering a general section of a pegmatite, we find that it is divided into three important parts. The upper section consist of an unweathered zone, which may vary from a few inches to as much as 15 or 20 feet in thickness, or may even continue downward throughout the depth of the entire pegmatite. Mica, both biotite and muscovite, is hard, firm and of good quality, particularly the ruby muscovite mica. The feldspars,[2,3] where they are unaltered, are also hard crystals. The quartz, of course, is always prominent as a hard material. Hornblende and other accessory minerals are firm. The second zone, which lies below this upper zone, varies in character, depending on the presence of moisture, or water. Water may enter the books of mica and either cause swelling, or deposit clay. The feldspar is attacked and will produce a certain amount of alkalies which continue to alter the feldspars into kaolin. The quartz is usually retained with only slight alteration. This weathering continues down into the second zone and produces kaolin.

Frequently biotite and vermiculite occur as the alteration of muscovite mica. In many cases the miners stop when they get to this weathered zone. It might be interesting to see if a shaft were sunk through this weathered zone, and the water removed by continuous pumping, if hard, clear mica and feldspar would be encountered below this weathered zone.

The third or final zone is, of course, the unaltered lower part of the pegmatite.[3] My experience has been that in many cases beautiful books of mica, some of large size, have been found close

to the surface, while a short distance below the surface weathering occurs. From there on, if the water is not diverted, good mica was not obtained. Large books were found with the centers and edges eaten, and the mica badly water stained and weathered. In many cases weathering continued downward 30 to 50 feet where the whole pegmatite was altered. The feldspars were altered to kaolin with scattered quartz grains in the wet kaolin. It was only a short time after this that the whole pegmatite softened and kaolin replaced the pegmatite.

It is possible that by sealing off the water and the weathered zone the alteration of the mica might have been prevented. One mine in northwest Clay County which produced a considerable amount of high grade muscovite mica during World War I was allowed to stand without sufficient drainage. The mica disintegrated. The pegmatite 22 feet wide, at a depth of 30 feet, became wet kaolin with scattered books of biotite and vermiculite. The vermiculite was probably the alteration of the muscovite mica.

On the other hand, in a mica mine opened up in northeast Clay County, the weathered zone was by-passed on the right side and the mine continued downward in solid ground with unweathered mica for at least 250 feet from the outcrop. This mine produced, during World War II, more high grade mica than did all the other muscovite mica mines in Alabama.

The writer here present his views on what happens in the weathering of a pegmatite. The upper part of the pegmatite may be above the accumulation of water and, therefore, the mica and feldspar are not affected, but as soon as the pegmatite passes under the surface, there is a certain amount of accumulation of water which tends to loosen the books of mica and slightly alter the feldspar. When this occurs the feldspars are partly weathered to kaolin, and in this process the alkalies are set free; these, in turn, produce a greater effect on the feldspars, and in the process of disintegration the alkalies become still stronger and finally eat into the feldspars and change them to kaolin. At the same time, they enter the books of mica along the plane of cleavage and this will tend to loosen further the layers until the mica is badly weathered, or destroyed. Finally, alteration still further converts the muscovite into biotite and thence to vermiculite in the soft kaolin mud. As the quartz does not weather, it becomes quartz grains scattered through the soft kaolin with the biotite and vermiculite. This, as I see it, is the process of disintegration, or weath-

ering, of the pegmatites. Beryl, corundum and other minerals which are not affected by the alkalies remain in the muddy kaolin.

REFERENCES CITED

[1] A pegmatite, as defined by Faye, Albert A., in A Gloscsary of the Mining and Mineral Industry: U.S. Bureau of Mines Bulletin 95, p. 496, 1920-47, consists of a quartz granite, or an igneous rock, generally coarse grained, but usually irregular in texture and composition. The feldspars contained in pegmatites are all highly alterable minerals.

[2] Frank W. Clark, in speaking of feldspars, gives the following statement: "The feldspars are all highly alterable minerals and the altered products are both numerous and important." This is found in The Data of Geochemistry, U.S.G.S. Bulletin 770, 5th Edition, p. 371—1924.

[3] Hugh D. Pallister, Projects Engineer, and Andrew Brown, Engineer, in the examination and report of the U.S. Bureau of Mines, Tuscaloosa Division, Mining Branch, and credited to the Staff Report, stated that, "The pegmatites are probably related to the same intrusions responsible for the granite." p. 16, Report of Investigation, 3905.

Mr. Otis M. Clarke, Jr., consulting Geologist, who has had a great amount of experience on bauxites and clays, and their weathered products, has agreed to discuss the weathering of pegmatites, and others are invited to take part in this discussion.

Discussion by Otis M. Clarke, Jr.

Consulting Geologist

Mr. Pallister's observations on weathering of mica quartz feldspar pegmatites, where he has reported extensive kaolinization of the pegmatites with the distribution of the mica occurring below relatively unweathered feldspars and mica, is an important contribution to the study of rock weathering. This also adds a note of caution to operators mining and prospecting pegmatites.

Location, General Geology

These pegmatites are located in the Piedmont crystalline belt which extends from east-central Alabama[1] northeastward along the eastern side of the Appalachain Mountain system. Briefly, the general geology is that of the pre-Cambrian and early Paleozoic

sediments subjected to regional metamorphism of varying intensity. Complex systems of pre-Cambrian Paleozoic and post-Carboniferous granite intrusions and basic sills have been described by many writers.

In view of recent works on granitization, and of field studies on the crystalline belt from Alabama to Virginia, it is concluded that these granites and granite gneisses are products of granitization, which is part of the regional metamorphism. These are graduations or transitions from granite to granite gneiss to migmatites to quartz mica schists. This gradation can be observed in Coosa County, Alabama, on any road crossing the western boundary of the Pinckneyville granite.[2]

A study of the weathered outcrops indicates that many fine-grained basic sills are metamorphosed calcarous, ferriferous beds rather than intrusions. This does not refer to the Triassic diabase, which cuts across formations.

The pegmatites occur in the quartz mica schist and are generally parallel to the plains of schistosity, but this is not a fixed rule. The pegmatites are found in regions of low grade or incipient granitization, characterized by grinte sills and migmatities.[3]

Normal Regional Weathering

The normal weathering profile in the Piedmont crystalline belt is a thin top-soil, or "A" zone, generally a little less than a foot thick, consisting of a sandy loam. This grades into a deep orange-red clay sub-soil, or "B" zone, one to two feet thick. The texture of the original rock is almost completely obliterated with the complete weathering of mica and feldspars. Quartz veinlets do extend through this zone, but they are broken and badly corroded.

The "C", or saprolite zone, extends from the clay stratum down to hard rock and may be fifty to more than a hundred feet thick. The weathering and decomposition of minerals decreases downward from completely weathered minerals at the top to weathering along the crystal boundaries only toward the bottom, but the original texture of the rock is retained through the entire saprolite zone. The rock is soft enough to be dug with a shovel without blasting. The zone is quite irregular and "ribs" of hard rock extend up through the soft saprolite.

The saprolite weathers to kaolinite, vermiculite, gibbsite, illite and geothite, but residual quartz and mica are the most abundant

minerals. The minerals present in the weathered profile depend on the rock type, composition of the original rock, and the extent the rock has been exposed to weathering. The saprolite weathering is typical latertic weathering characteristic of humid tropics without long pronounced wet and dry seasons. This is not an advanced or extreme stage of laterization.

Pegmatite Weathering

Hunter and Hash (1949) describe pegmatites and alaskites in western North Carolina, including the Spruce Pine district, as altering to a mixture of halloysite and kaolinite, with the halloysite predominating in some deposits. Since halloysite, a kaolin type mineral, is quite similar to kaolinite, it is suggested that halloysite may be present in the Alabama pegmatites.

Watertable Weathering

Mr. Pallister's paper brings out the effects of intense chemical weathering that occurs in depth, presumably near the top of a fluxating water table. This weathering is accelerated by exposure to air during mining. This is a phase of ground-water geochemistry that has received relatively little attention.

Possibilities

In conclusion, it is pointed out that the Piedmont crystalline complex is one of the most challenging geological problems in Alabama today, and this region does have undeveloped economic possibilities. Older geological work is obsolete. Relatively little detailed mapping has ever been done, or is available. This region is being restudied[4, 5] in other southeastern states, and Alabama studies should be coordinated with other work being done, as the key to understanding Alabama structures may be in Georgia or North Carolina.

It is noted that beryl is found in a number of pegmatites. Beryllium could be present in other forms. The kaolinite and possible halloysite zone may be more valuable for ceramic purposes than the value of the original mica.

LITERATURE CITED

1. Bur. of Mines Staff, Tuscaloosa Sta. (1946), Mica and beryl examination in Cleburne, Randolph, Clay, Coosa, Chilton, Tallapoosa and Lee Counties, Alabama. U.S. Bur. of Mines R.I. 3905.
2. Gault, H. R. (1945) Petrography, structure and perrofabrics of the Pinkneyville quartz diorite, Alabama, Geol. Soc. of Am. bull. v. 56, p. 181-246.
3. Hunter, C. E. and Hash, L. J. (1949) Halloysite deposits of western North Carolina, N. C. Dept. of Cons. and Dev. bull. 64.
4. King, P. B. (1955) A geologic section across the southern Appalachians: An outline of the geology in the segment in Tennessee, North Carolina and South Carolina. Guides to Southeastern Geology, Geol. Soc. of Am. p. 332-373.
5. Olson, J. C. (1952) Pegmatites of the Cashiers and Zirconia districts, North Carolina. N. C. Dept. of Cons. and Dev. bull 64.

"Sink-Hole" Bauxite Deposits in Northeastern Alabama

Otis M. Clarke, Jr.

Project Geologist, Geological Survey of Alabama

Tuscaloosa, Alabama

Bauxite and kaolinite deposits of northeastern Alabama occur in sink-holes in Cambrian and Ordovician carbonate rocks. The Alabama deposits, probably of lower Tertiary age, are very similar in occurrence and origin to the bauxite deposits found in northwestern Georgia, eastern Tennessee and western Virginia.

Bauxite was discovered near the village of Rock Run, Cherokee County, in a brown iron ore district in 1889. Mining was started soon after the discovery and was continued until 1919. Only high grade chemical and metallurgical ores were shipped, and the low grade bauxite and the kaolin clays were wasted on the dumps. This district has been idle since 1919, but similar bauxite deposits are being mined near Rome, Georgia.

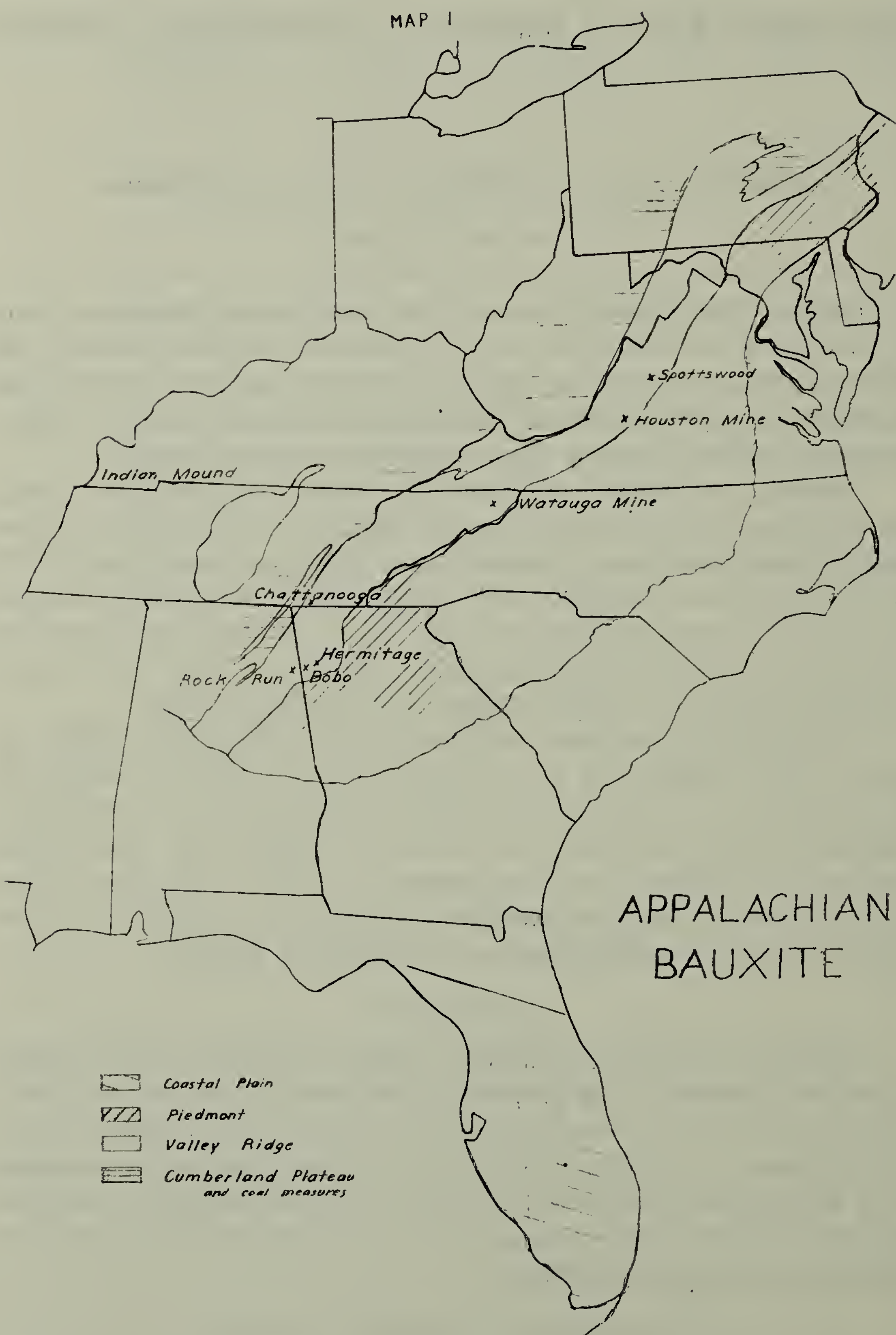
The Alabama deposits are described by McCalley (1892), by Jones (1929) (1940) and by Coulter (1948). The U. S. Geological Survey and U. S. Bureau of Mines investigated the district in 1942-43, drilling 222 holes for a total of 13,000 feet. The writer directed the drilling and exploration of similar deposits in Virginia, Tennessee and northwestern Georgia for a private company and has made investigations in the Alabama district.

Locations

Bauxite is found in Cherokee, Calhoun, DeKalb and Talladega Counties, Alabama. The location of deposits shown on Map No. 2 were taken from descriptions given in Alabama Geological Survey Circular 7 by Jones (1929). The largest "cluster" of deposits is in southeastern Cherokee County near the Georgia state line. Map No. 1 shows the location of all the Appalachian bauxite districts and the regional geology.

Topography and Host Rocks

The Appalachian bauxites are in the Valley-Ridge topographic province, which is made up of long narrow ridges extending in a


MAP I
Spottswood
Houston Mine
Indian Mound
Watauga Mine
Chattanooga
Hermitage
Rock Run
Bobo
APPALACHIAN
BAUXITE
Coastal Plain
Piedmont
Valley Ridge
Cumberland Plateau
and coal measures

northeasterly direction and parallel broad valleys with flat to rolling, hilly surfaces. Some sink-holes occur, but there is no strong devlopment of karst-type topography.

The tops of ridges in the Alabama-Georgia district are at approximately 1900 feet elevation with a maximum relief in the order of 1000 feet. Bauxite outcrops are found at surface elevations of 900 to 1100 feet, but there are no surface indications at the outcrops to suggest the presence of bauxite-kaolin deposits, sink-holes or anything other than the normal chert residuum over carbonate rocks.

Bauxite deposits are found both on the Knox dolomite, of Cambrian-Ordovician age and on the Shady dolomite of lower Cambrian age. Apparently, there is no stratigraphic control, but many deposits are found on the Copper Ridge dolomite of the Knox group.

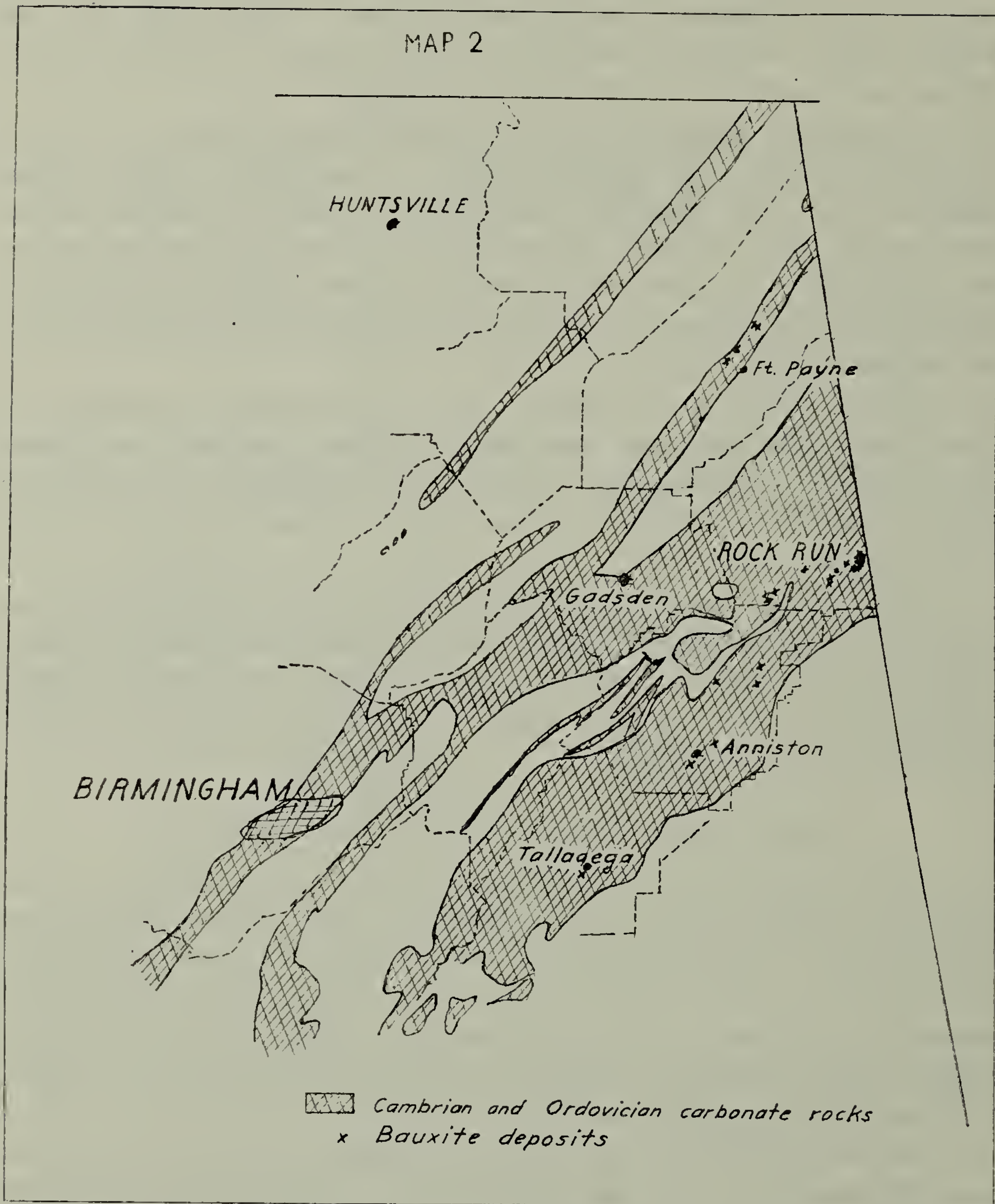
The general structure is that of large thrust faults and local folding of less competent strata. Some deposits are lined up along a major fault, such as the bauxites on Missionary Ridge at Chattanooga, but other deposits are not connected or associated with any known fault system.

Other Appalachian Sink-Hole Bauxites

The northwestern Georgia bauxites are quite similar to the Alabama deposits, being a continuation of the same district. The Chattanooga, Tennessee, bauxites are located on a dissected terrace on the eastern side of Missionary Ridge at approximately 900 feet elevation and one to two hundred feet below the crest of the ridge. They occur as pockets of bauxite and kaolin in the chert residuum from the Copper Ridge dolomite.

The Watauga Mine, in the northeastern corner of Tennessee near Elizabethton, is on the lower slope of Holston Mountain with the outcrop elevation at 2160 feet on what is apparently a remnant of a peneplain largely removed by erosion. The host rock is the lower part of the Shady dolomite.

There are two bauxite districts in Virginia. Ore has been mined from a group of deposits in the Shenandoah Valley near Spottswood, Agusta County, sixteen miles northeast of Lexington in the upland hills that form the divide between the James and Shenandoah River systems. The host rock is the Knox dolomite. The other occurrence is the Houston Mine on the Blue Ridge Mountains near Natural Bridge in Botetourt County. Reddish iron-



stained kaolin with large bauxite bolders occurs in the residual clays of the Shady dolomite adjacent to a manganese mine.

Occurrence Shape and Size

There is no significent difference between the bauxites found on the lower Cambrian or Ordovician limestones, and there is no significent difference between the bauxites found in Alabama or Virginia. The descriptions of mineralogy, occurrence and origin would apply to all districts.

The Appalachian deposits are relatively small and few deposits exceed 200 feet in any dimension. The typical shape is that of a funnel with an oval cross-section. The sides may be quite steep in the upper part. The bottom shape is characteristic of sink-holes, and the location of orebodies within a district is the same as that expected for sinkholes.

The bauxite is generally massive and is always surrounded by kaolin clays. Frequently, bauxite occurs as two or more pods separated by kaolin, and some deposits are predominantly clay with bauxite bolders. The structural relationship between bauxite and kaolin within a deposit is most complex. It is definitely not a sedimentary feature.

Mineralogy

The Appalacian bauxites are mainly gibbsite, the aluminum tri-hydrate, with minor amounts of kaolinite, and frequently some hematite. Two to three percent titania is always present. Diaspore and boehmite, aluminum mono-hydrates, have not been identified. The kaolin clays surrounding the bauxite are comparatively pure kaolinite, but the clays toward the outside of the deposit may be stained with hematite. Halloysite, a kaolin-type mineral, may be fairly abundant, but it is difficult to distinguish from kaolinite and generally remains undetected. Quartz is conspicuously absent both in the bauxite and in the clay within the deposit.

The limestone residuum contrasts conspicuously with the bauxite-kaolin deposits. The residuum consists of chert fragments, and occasionally of bolders of undissolved limestone in a silty clay matrix. The clays are mixture of illite, montmorillonite and kaolinite-type minerals.

The bauxite is pisolitic, with the pisolites being more abundant toward the top of the orebodies, but there is no firm relationship between the pisolites and grade. The color of the bauxite is controlled by the iron impurities. Low-iron bauxite is light grayish white to cream colored, and high-iron bauxite, but it may be stained red to purple. Reddish clays are usually found toward the edge of the deposits. The kaolin has a very smooth texture and breaks with a concoidal fracture. Pisolitic kaolin has been found in a few pits.

The bauxite is often surrounded by a gradation zone of "bauxitic clay," which is a mixture of gibbsite and kaonlite with the

kaolinite predominating. Some of the low grade bauxite deposits may be classed as bauxitic clay rather than bauxite.

Small seams of impure lignite have been found in contact with clays. They are usually tilted due to collapse of underlying limestone after deposition.

Conditions of Deposition

The marked difference between the clay mineralogy of the Recent soils and clays in the regions and clay fillings in the bauxite deposits point to a past period of bauxitization with different climatic conditions. Lignite specimens from the Watauga Mine were too badly decomposed for age determination, but lignite from bauxite deposits at Indian Mound in west-central Tennessee have been dated as post-Cretaceous and pre-Miocene. Considering that the bauxites are restricted to traps in an old weathered surface, it is quite possible that the Appalachian bauxites are contemperanous with the Arkansas bauxites, which are lower Eocene in age.

Toward the end of the Cretaceous period, the Appalachian region had been reduced to a peneplain, which probably had less relief than the present surface with some sandstone ledges remaining above the limestone valleys. The thick accumulation of weathered chert indicates a long period of chemical weathering. This was accompanied by the development of underground limestone solution channels and more intense karsitification of the surface than that exhibited at the present time.

The fine texture of the bauxite-clay filled sink-holes and the complete absence of chert within the deposit point to lacustrine sedimentation in small lakes similar to those found in parts of Florida today. The presence of lignite in the upper parts of some deposits also point to lake filling and swamps. The presence of sand along the rim of some deposits indicate lake sedimentation with sand dropping out toward the edges and clay depositing within the lake.

Source Material and Geochemical Changes

The source of the sediments could be clay residuum from nearby limestones and shales. With a past tropical or sub-tropical humid climate the normal illite clays would be oxidized and partly leached with kaolinite forming as an end product. If the feldspathic crystalline rocks east of the Blue Ridge Mountains were

the source or partly the source, the clay sediments would be a mixture of kaolinite with some gibbsite.

Judging from the bauxite-kaolin structures found in the deposits, it is evident that bauxitization took place after deposition and not prior to it. The desilication consisted of complete leaching of quartz silt deposited with the clay fraction and the alteration of all illite and montmorillonite-type clays to kaolinite or kaolin-type clays. Gibbsite was formed by desilicatin of kaolinite. The partial removal of silica was accompanied by the near-complete removal of calcium, magnesium, sodium and potassium from the bauxite and clays.

Iron was largely removed from many of the deposits. The iron removal was probably a result of swamp conditions resulting in the generation of organic acids which leached the iron. The fact that lignite is found only in low-iron deposits supports this conclusion.

The leaching of silica was accompanied by the precipitation of alumina, probably first as a jel, later crystallizing to gibbsite. The last stage was the resilication of some gibbsite to kaolinite. This process is indicated by the occasional occurrance of relatively pure kaolinite with the pisolitic texture, characteristic of bauxite.

Utilization

The economical use of the Appalachian bauxites depend as much on using the kaolin and bauxitic clay as on using the bauxite. Since much of the clay is nearly pure kaolinite and low in both iron and alkalies, it can be used for refractories and chemicals after selective mining.

Acknowledgments

The writer wishes to express appreciation to Prof. R. Q. Shotts for critical review of the manuscript.

LITERATURE CITED

1. Adams, G. I., (1927) Bauxite deposits of the southern states, Econ. Geol. v. 22 No. 6 p. 615-620.
2. Bridge, Josiah, (1950) Bauxite deposits of the southeastern United States. Symposium on mineral resources of the southeastern United States, Univ. Press, Knoxville, Tennessee, p. 170-201.

3. Coulter, D. M. (1948) Bauxite in Cherokee and Calhoun Counties, Alabama, U.S. Bur. of Mines R.I. 4223. 28 p.
4. Harder, E. C. (1949) Stratigraphy and origin of bauxite deposits, Geol. Soc. Am. bull. v. 60, No. 5, p. 887-907.
5. Hayes, C. W. (1895) Bauxite, U. S. Geol. Survey 16th Ann. Rept. pt. 3, p. 551-597.
6. Jones, W. B. (1929) Summary report on the bauxite deposits of Alabama, Ala. Geol. Survey Cir. 7.
8. ——— (1940) Bauxite deposits of Alabama, Ala. Geol. Survey Bull. 47. 94 p.
9. McIntosh, F. K. (1949) Investigation of Hamilton County bauxite district, Tennessee, U. S. Bur. of Mines R.I. 4550. 31 p.
10. McCalley, Henry (1882 Alabama bauxite, Ala. Ind. & Sci. Soc. V. 2 p. 20-32.
11. White, W. S. (1952) The bauxite deposits of Floyd, Bartow and Polk Counties northwest Georgia, U. S. Geol. Survey Cir. 193. 27 p.

INDEX TO VOLUME 32

Due to an error in pagination of issue No. 1 the index for this volume is as follows: Issue No. 1 (Jan.) is composed of pages 479-548. Issues 2, 3, 4 (April, July, Oct.) are composed of pages 77-288.

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
HOWARD COLLEGE
BIRMINGHAM, ALABAMA

VOLUME 33 JANUARY, 1962 NUMBER 1

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 33 JANUARY, 1962 NUMBER 1

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

Complete Papers

Sensitivity of Euglena Gracilis Klebs To Ultra-Violet Radiation Following Temperature Treatments*

Margaret J. Waldrep

Department of Biology, University of Alabama,

University, Alabama

This study represents an extension of the work begun at the University of Alabama by Herndon (1948) and Wilson (1949) in determining the effects of ultra-violet irradiation on cell morphology of *Euglena gracilis* Klebs and the ability of the organism to survive ultra-violet treatments.

Herndon correlated survival with intensity of radiation, varying the time of exposure and the distance from the ultra-violet source. Wilson's work compared variations in wave lengths and times of exposure keeping the distance constant.

The present work using the same organism introduced temperature as a variable. Exposure time was also varied with a constant distance used.

This study was undertaken with the following objectives: determination of the lethal effects on *E. gracilis* pre-treated at various temperatures before exposure to irradiation; determination of the lethal effects of irradiation for organisms grown at these same temperatures; investigation of cellular changes occurring following exposure to irradiation; determination of those relationships, if any, that exist between survival, temperature, and time of exposure.

MATERIALS AND METHODS

Cultures of *E. gracilis* were obtained from the Culture Collection of Algae, Indiana University, Bloomington, Indiana (Starr, 1960).

Three types of experiments were carried out. In the preliminary experiments, euglenae cultures (not bactria-free) were used; in the final experiments all cultures were bacteria-free. The first two experiments were done in different media; the third were

* This paper is based upon the author's master's thesis. It was done in 1961 in the Department of Biology of the University of Alabama.

This research was supported by a National Defense Education Act Fellowship.

irradiated in ion-free water. The first two experiments represent pretreatment at various temperatures for 12 hours prior to exposure; the third represents growth at these temperatures.

The temperature of the culture room at the University of Alabama is approximately 22 C plus or minus 1 C. Fifty per cent lethality for the euglenae grown at 22 C was obtained after approximately 45 seconds of ultra-violet irradiation; thus 30, 45, and 60 seconds exposure times were decided upon. These were used throughout the experiments.

Variations of 10 C were used. Pretreatment and growth at 11, 22, 33, and 44 C were attempted.

The ultra-violet source was a General Electric 15 watt germicidal lamp; 80% of the energy was emitted in the line of about 2530 A.

The cultures used in this investigation were artificially illuminated by cool white fluorescent bulbs. They were placed on glass shelves receiving approximately 100 foot candles of light. The illumination period was 12 hours of light alternating with 12 hours of darkness.

In the preliminary experiments, stock cultures were maintained in soil-water medium (Pringsheim, 1950). Approximately two to three weeks before the treatment with ultra-violet light, organisms from these stock cultures were inoculated into a 1:1 mixture of the basic inorganic salt medium used by Bold (1957), and pea soup medium (Baker, 1926). The protozoan grew more rapidly in this medium than in soil water tubes.

After approximately two weeks growth, the organisms were abundant. Five millimeters of medium were placed in each of six petri dishes. Counts were made with an Improved Neubauer hemacytometer slide after being mixed with the Mix-Mag, a magnetic stirring device, to assure homogeniety. Counts were made only of those exhibiting movement. One dish was set aside for the control; the other five were exposed to ultra-violet light at a distance of 22.6 cm. Twelve hours following irradiation, counts were again made, after stirring of the control and experimental groups.

During the dark period of illumination, the petri dishes containing the *Euglena* suspension were transferred to an incubator set for the desired temperature; 12 hours later they were removed, immediately irradiated, and replaced on the illuminated shelves. At the end of 12 hours, survival counts were made as described above.

Results were obtained for organisms grown at 22 C and for those left 12 hours at 11 and 33 C prior to irradiation.

Attempts to pretreat euglenae at 44 C were unsuccessful; when the organism-medium suspension was placed in an incubator set for 44 C, the euglenae "encysted" and did not recover after 12 hours, so that it was not possible to distinguish the effects of ultra-violet by the criterion established.

Since the earlier treatments were in bacterized cultures in a single culture medium, an attempt was made to determine whether results are significantly different in bacteria-free cultures or in other media.

A bacteria-free culture of *E. gracilis* var. *bacillaris* was obtained from the Culture Collection of Algae; these were maintained in "Polytomella" medium (Starr, 1960). Only cultures containing no bacteria were used. After approximately two weeks growth the cultures were ready to use. Counts were made before irradiation on hemacytometer slides. The cultures were centrifuged and placed in sterilized ion-free water. Following irradiation, cultures were again centrifuged and the water replaced with fresh, sterile medium. Twenty-four hours later counts were made of those organisms surviving.

This procedure was followed for cultures grown at 22 C and those grown at 33 C. An attempt was made to grow them at 11 C but in two weeks time, there was little evidence of growth.

A third set of experiments was done using bacteria-free "Polytomella" medium. These were carried out like the first experiments except the organisms were irradiated in the "Polytomella" medium. Hanging drop slides were made and observed at regular intervals during the 24 hours following exposure to irradiation.

RESULTS

Figures I and II represent a summary of the relationships of survival, temperature of culturing, and time of radiation exposures.

The graphs show that variations of temperature resulted in a difference in the number of organisms surviving the ultra-violet dosage. Increasing the temperature (33 C) above that used for culturing (22 C) was more favorable for survival than lowering the temperature (11 C) below that employed for culturing.

The data indicated that at 11 C in order to obtain 50% lethality, less than 30 seconds irradiation must be given; whereas, at 33 C approximately 60 seconds or more exposure must be given. Fifty per cent lethality is obtained at 22 C by subjecting euglenae to

ultra-violet irradiation for approximately 45 seconds.

All results are considered statistically significant to the 1% or 5% level as indicated by the Snedecor "t" Test (1946) except those receiving 30 seconds ultra-violet irradiation at 33 C, and the 45 seconds exposures in the "Polytomella" medium were statistically insignificant.

Control counts varied little during the experimental time. The organisms subjected to 12 hours of 33 C seemed more active than they were prior to this increase in temperature. The organisms that underwent 12 hours at 11 C were less active and in some controls as many as 50% of the organisms immediately after this treatment were encysted. Thus some were irradiated while encysted. Twelve hours later most of the controls showed little encystment.

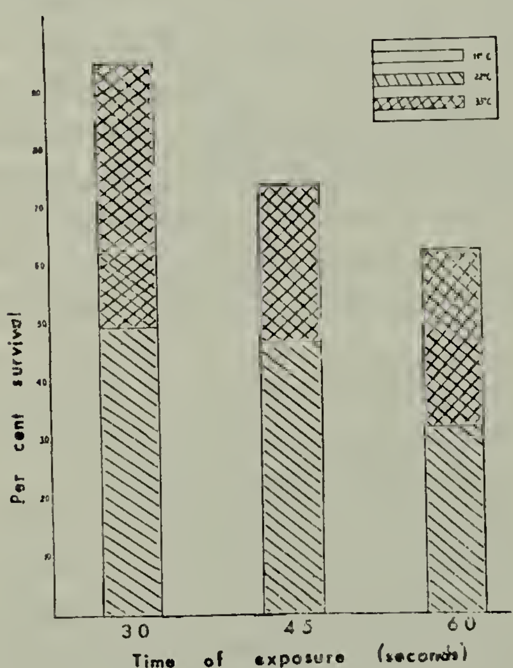


FIGURE I

Summary of the results obtained when euglenae were grown at 22 C and 33 C prior to ultra-violet exposure. No comparison can be made to 11 C as little growth occurred at this temperature. Organisms were irradiated while in ion-free water.

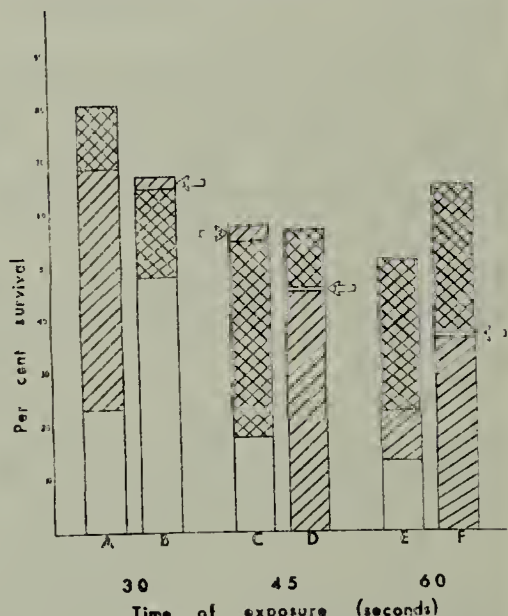


FIGURE II

Summary of results obtained when euglenae were pretreated at 11 C, 22 C, and 33 C prior to exposure to ultra-violet. Organisms used in these experiments were irradiated while in bacterized, pea soup-inorganic salt medium (A, C, and E) and bacteria-free "Polytomella" medium (B, D, and F). The numbered arrows refer to specific points taken up in the discussion. The legend is the same as for Fig. I.

Concerning morphological changes, the effects of ultra-violet

irradiation as brought out by previous workers (Herndon, 1948; Kay, 1952; Heilbrunn and Mazia, 1936) are evident within a few seconds after exposure. A description of the liquefaction and vacuolization that occurs is available in any of these works.

In addition to these cytological changes, there were indications observed by this author and other workers, that chlorophyll changes may occur as a result of 60 seconds exposure; also flagellar action may be modified. Occasionally these same modifications could be seen in the controls as well as the experimentals. Also the number of encysted forms present after irradiation increased.

DISCUSSION

Using *E. gracilis*, Herndon (1948) correlated survival with intensity of radiation, varying the time of exposure and the distance from the ultra-violet source. He found that at a distance of 22.6 cm. and 45 seconds of exposure in bacterized, pea soup-organism suspension, a little less than 50% of the euglenae exposed were killed; and at 30 seconds of exposure a little over 60% died as a result of the ultra-violet light treatment. These experiments were carried out at room temperature corresponding approximately to 22 C. Thus a comparison of the lethal effects obtained by Herndon with the ones obtained from the present study, using pea soup-inorganic salt medium, bacterized suspension can be made. The survival rates obtained were: at 30 seconds exposure 65% survived; at 45 seconds 58% survived and at 60 seconds irradiation 23% survived. The greatest variation between these two studies occurred at 60 seconds exposure with this author obtaining a 12% decrease in survival value. At 45 seconds exposure the difference was 8% and at 30 seconds the difference was 5%.

Wilson (1949) compared variations in wave lengths and times of exposure with a constant distance. He found no measurable lethal effect on *E. gracilis* for continuous radiations up to 24 hours at wave lengths of 3650, 4050, and 4360 A. These wave lengths were obtained from filters emitting 15%, 12%, and 14% transmission, respectively, of the 3300 lumens initial intensity supplied by the 100 watt General Electric mercury vapor lamp.

The present experiments were carried out to determine whether the results obtained from the initial experiments could be due to media changes or the presence of bacteria. After repeating the experiments in bacteria-free "Polytomella" medium and in sterilized, ion-free water using bacteria-free cultures, the data indicated

the results are probably not due to media changes or to the presence of bacteria.

Figure I, a graph of the results obtained when organisms were grown at 22 C and 33 C, shows a linear relationship between time of exposure, survival, and temperature. An increase in temperature produced in each case an increase in the number of organisms surviving.

In one place on Figure II, the linear relationship expected did not exist. At 33 C the proportion of organisms surviving 60 seconds of ultra-violet light was greater than the number surviving 45 seconds. Also an increase in temperature produced an increase in number of organisms surviving except at four places as shown by the numbered arrows. At (1), the percentage of organisms pretreated at 22 C surviving 30 seconds of exposure exceeded those pretreated at 33 C by approximately 2%. At (2), a 3% difference is noted between 22 and 33 C pretreated organisms at 45 seconds exposure. The third discrepancy is indicated at 45 seconds exposure of 11 and 22 C pretreated organisms; the ratios obtained in this case differed by less than 1%. The fourth exception involves the 60 seconds of exposure of pretreated organisms at 11 and 22 C where survival ratios again were practically the same.

Organisms pretreated at 11 C required less than 30 seconds irradiation to obtain 50% lethality. On the other hand, organisms pretreated and grown at 22 C required approximately 45 seconds of exposure. Those organisms grown and pretreated at 33 C needed 60 seconds or more exposure to the ultra-violet source to obtain 50% lethality.

It was surprising to note that the results with the organisms grown at the experimental temperatures varied little from the results obtained following pretreatment at these temperatures.

The effects of temperature on pretreated organisms as well as on organisms grown at the same temperature appear to be the same. Increasing the temperature (33 C) above that used for culturing (22 C) was more favorable for survival than lowering the temperature (11 C) below that employed for culturing.

The controls following treatment at 11 C were less active than they were prior to this treatment and at times as many as 50% of the organisms were encysted. Thus some were irradiated while encysted and less of these survived the radiation. It appears that encysted forms are less tolerant of ultra-violet radiation and this may account for the difference in the results of 11 C pretreat-

ments. In the 12 hours following these temperature treatments the controls recovered from the encystment. Attempts to grow euglenae at 11 C were unsuccessful. Many investigators (Sizer, 1943; Beatty and Beatty, 1959) believe that at temperatures lower than the optimum the catalyzed reaction is affected. Sorokin (1960) stated that at lower temperatures the over-all growth of an algal suspension is greatly retarded by the effect of low temperature on cell division.

The difference obtained as a result of 22 and 33 C temperature treatment was not as great as was obtained at 11 C. The controls following temperature treatment at 33 C seemed more active than they were prior to this treatment. This increased metaboly is in keeping with results of Sorokin (1960) who stated that there may exist an increase in metabolic rate with an increase in temperature. Temperatures higher than the optimum may inactivate the enzyme itself. The optimum temperature probably was exceeded when the organisms were pretreated at 44 C since immediate encystment occurred and recovery was not evident in the ensuing 12 hours.

Aside from the enzymatic effects of temperature, chromosomes seem to be the most effected. Bailey (1954) pointed out that a decrease as well as an increase in chromosomes may occur as a result of cold treatment. In addition to chromosome changes: heat (Wolken, Mellon, and Greeblatt, 1955) has been shown to increase chlorophyll synthesis; Brawerman and Chargaff (1955) stated that when *E. gracilis* is kept in cold water one to two hours a decrease in cell wall resistance occurs without affecting the chloroplasts and other cell fractions.

It has been shown (Wood, 1954) that pre-irradiation heat treatment of yeast cells more effectively induces x-ray damage than does post-irradiation heat treatment. Whether or not this is true for ultra-violet radiation has not been demonstrated. A study of temperature variation following irradiation would be desirable.

The particular mechanisms by which ultra-violet inactivates cells and the site of action is a question under considerable discussion. The effect has been attributed to the action of the radiation on the suspending material as well as on the cell wall, on enzymes in the organism, on the colloidal structure of the cytoplasm, and on nuclear material or material which controls cell division (Hollaender and Claus, 1936). The present study utilized different media to determine what effect, if any, differences in media types or media changes produced by irradiation would have

on the ability of *E. gracilis* to survive the dosage. Media changes, if they occurred, were not demonstrated and media differences seem to have no effect. Results obtained from organisms irradiated in water differed little from results obtained when the organisms were irradiated in other media.

Kelner (1952) discovered that light induces recovery from ultra-violet irradiation injury. This process is called photoreactivation. It is said that photoreactivation may be caused by wave lengths extending from the very near ultra-violet to the blue end of the spectrum. A review of the literature has shown that contrasting views exist. For example, Hirshfield and Giese (1953) reported no evidence for photoreactivation in the ultra-violet injured cells of *Blepharisma*; whereas, Kimball and Gaither (1951) using *Paramecium* have shown that light immediately following exposure to approximately 2000 A considerably decreases the effect otherwise to be expected. In the present study, following ultra-violet treatment, the organisms were placed on the culture room shelves where they received 12 hours of illumination of 100 foot candles before the survival counts were made; thus photoreactivation could have occurred but no attempt was made to measure the effect of post-irradiation light. If photoreactivation occurred there was a differential in the over-all effect.

The answer as to the specific effects and sites of action of ultra-violet irradiation on living cells and the apparent interaction of light and temperature is not evident. More microscopic and chemical analysis seems desirable. The data obtained from this study clearly indicated that an increase in temperature enhanced the ability of the organisms to survive the ultra-violet dosage; whereas, a decrease in temperature reduced the ability of the euglenae to survive ultra-violet radiation.

CONCLUSIONS

Using the techniques described, the following conclusions are indicated:

1. In keeping with the results of other workers, *E. gracilis* grown at 22 C and irradiated for approximately 45 seconds with ultra-violet light emitting 2530 A produced 50% lethality; this was also true for organisms pretreated at this temperature.

2. Organisms pretreated and grown at 33 C and irradiated for approximately 60 seconds produced 50% lethality.

3. Euglenae pretreated at 11 C would produce 50% lethality after irradiation below 30 seconds exposure.

4. A linear relationship existed between survival, temperature, and exposure time of organisms grown at the various temperatures. With one exception, this was also true of organisms pretreated at the given temperature.

5. Organisms grown at 22 and 33 C showed an increase in survival value with an increase in temperature. The same was true of pretreated organisms, except in four instances where slight or no increase occurred.

LITERATURE CITED

1. Bailey, Paul C. 1954. Differential reactivity in chromosomes as an indicator of species in *Trillium*. Bot. Gaz. 115(3):241-248.
2. Baker, Woolford B. 1926. Studies on the life histories of *Euglena*. Biol. Bull. 51:321-362.
3. Beatty, A. V. and Jeanne W. Beatty. 1959. Metabolic inhibitors and chromosome rejoining. Am. Jour. Bot. 46:317-323.
4. Bold, Harold C. 1957. Morphology of plants. Harper and Brothers, Publishers, New York. pp. 622-623.
5. Brawerman, George and Erwin Chargaff. 1959. Changes in protein and ribonucleic acid during the formation of chloroplasts in *Euglena gracilis*. Biochem. et Biophys. Acta. 31(1):164-171.
6. Heilbrunn, L. V. and Daniel Mazia. 1936. The action of radiation on living protoplasm. *In* Dugger, Benjamin M. Biological effects of radiation. McGraw-Hill Book Co., Inc., New York. pp. 625-628.
7. Herndon, W. R., Jr. 1948. Influence of ultra-violet radiation upon *Euglena gracilis* Klebs. Thesis. University of Alabama (unpublished).
8. Hirshfield, H. and A. C. Giese. 1953. Ultra-violet radiation effects on growth processes of *Blepharisma undulans*. Exptl. Cell Res. 4(2):283-294.
9. Hollaender, Alexander and Walter D. Claus. 1936. The bactericidal effect of ultra-violet radiation of *Escherichia coli* in liquid suspensions. Jour. Gen. Physiol. 19(5):753-765.
10. Kay, Emily Patricia. 1952. Effects of ultra-violet and x-radiation on the chromatophores of *Platypoecilus Masculatus* Gunther, variety *Rubra*. Thesis. University of Alabama (unpublished).
11. Kelner, Albert. 1952. Experiments on photoreactivition with bacteria and other microorganisms. Jour. Cell. and Comp. Physiol. 39 (suppl. 1):115-117.
12. Kimball, R. F. and Nenita Gaither. 1951. The influence of light upon the action of ultra-violet on *Paramecium aurelia*. Jour. Cell. and Comp. Physiol. 37(2):211-233.
13. Pringsheim, E. G. 1950. The soil-water technique for growing algae. *In* Brunel, Jules, G. W. Prescott, and L. H. Tiffany. The culturing of algae. The Charles F. Kettering Foundation. pp. 19-26.
14. Sizer, I. W. 1943. Effects of temperature on enzyme kinetics. Enzymol. 3:35-62.

15. Snedecor, George W. 1946. Statistical methods. The Iowa State College Press. The Collegiate Press, Inc. Ames, Iowa. p. 65.

16. Sorokin, Constantine. 1960. Kinetics studies of temperature effects on the cellular level. Biochem. et Biophys. Acta. 38(2):197-204.

17. Starr, R. C. 1960. Culture collection of algae at Indiana University. Am. Jour. Bot. 47(1):67-86.

18. Wilson, R. C. 1949. Effects of monochromatic ultra-violet radiation on *Euglena gracilis* Klebs. Thesis. University of Alabama. (unpublished).

19. Wolken, J. J., A. D. Mellon, and C. L. Greeblatt. 1955. Environmental factors affecting growth and chlorophyll synthesis in *Euglena*. I. Physical and Chemical. II. The effectiveness of the spectrum for chlorophyll synthesis. Jour. Protoz. 2(3):89-96.

20. Wood, Thomas H. 1954. Influence of temperature and phase state on x-ray sensitivity of yeast. Arch. Biochem. and Biophys. 52(1):-157-174.

The Non-Crustose Lichens of the Howard College Natural Area

Herbert A. McCullough
Howard College, Birmingham

There has been little published work specifically cataloging the lichens of Alabama. Mohr's *Plant Life of Alabama,* published in 1901 and recognizing species of lichens, is the only such list in print. The present work is a preparatory investigation looking towards a study of the lichens of the state of Alabama as a long-range project.

The Howard College Natural Area is a tract of sixty acres set aside for scientific and educational purposes and administered by the Department of Biology of Howard College. The Area is located in Jefferson County on the north slope of Shades Mountain and in the adjacent Shades Valley at the southern edge of the Birmingham-Big Canoe Valley of the Valley and Ridge Province of Alabama. Shades Mountain is formed predominately from rocks of the Pottsville formation and the adjacent Shades Valley is underlain by the Floyd Shale. (Johnston, 1930).

The Howard College Natural Area is covered with an oak-hickory forest, a part of the eastern deciduous forest climax. The predominate trees are the oaks, including *Quercus alba, Q. stellata, Q. niger,* and *Q. velutina,* with *Q. montana* being the most predominant tree in the Area. The hickories in the Natural Area are not as frequent as the oaks. They include chiefly *Carya glabra, C. ovata,* and *C. pallida.* Other typical trees with lower frequency values are *Liriodendron tulipifera, Fagus grandifolia, Acer rubrum,* and numerous pines including *Pinus echinata, P. taeda, P. virginiana,* and rarely *P. palustris.* The understory includes specimens of *Cornus florida, Cercis canadensis,* and *Acer leucoderme.* The shrub layer is composed chiefly of *Gretagus, Hydrangea quercifolia, Vaccinium,* and numerous azaleas. The herbaceous layer is a rich stratum with representatives of most of the familiar species of wild flowers.

Collection of lichens from the Howard College Natural Area were made chiefly during the fall of 1961 and early spring of 1962. Specimens are preserved in the Howard College Herbarium with available duplicates being in the U. S. National Museum. Dr. Mason E. Hale and Dr. I. Mackenzie Lamb verified the author's determinations. Nomenclature follows Hale and Culberson (1960).

The Howard College Natural Area presents good habitats for foliose and fruticose lichens. Several rocky wet-weather streams pass through the area, and there are a few small sandstone outcrops pre-

sent. Decaying stumps and fallen logs, along with the standing timber, are good substrates. Of the trees, the oaks are most favorable. *Quercus montana* is unquestionably the best substrate for corticolouse species in the Natural Area.

Forty-six different species of foliose and fruticose lichens were collected in the study area. Table 1 shows the distribution of these species among the more common genera.

Table I. NUMBER OF SPECIES

Parmelia	17
Cladonia	8
Anaptychia	6
Physcia	4
Other species (genera)	11 (10)
Total	46

The genus *Parmelia* is the most frequent in the Natural Area. The most common species were *P. caroliniana* found on a variety of trees, *P. aurulenta* on all substrates (sandstone, decaying wood, and the bark of trees), *P. rudecta* collected from oaks, hickories, and maples, and P. *tinctorum* found on oaks and decaying wood. The following list indicates the species collected:

P. aurulenta
P. caperata
P. caroliniana
P. crinita
P. epiclada
P. formosana
P. galbina
P. hubrichtii
P. hypotropa
P. isidiata
P. livida
P. obsessa
P. perforata
P. reticulata
P. rudecta
P. subcrinita
P. tinctorum

Most of the Cladonias were collected on decaying wood; however, *Cladonia pityrea* was fairly common on bark at the base of the various pine trees.

The Cladonias collected were as follows:

C. apodocarpa
C. capitata
C. chlorophaea
C. cristatella
C. incrassata
C. pityrea
C. ravenelii
C. squamosa

The *Anaptychia* were found chiefly on the bark of oaks although a few specimens were collected on sandstone. The following species were obtained:

A. cassarettiana

A. dendritica var propagulifera
A. domingensis
A. palmatula
A. obscurata
A. speciosa

The Physcias were found in the Natural Area exclusively on bark or on moss growing on trees. Those collected were:

P. ciliata
P. culbersonii
P. orbicularis
P. tribacoides

The other species, grouped in ten genera, are listed in Table 2. The most common substrate is named beside each species:

Table 2.

LICHEN	SUBSTRATE
Coccocarpia cronia	Hickories and sandstone
Leptogium cyanescens	Bark and sandstone
Lobaria erosa	Oaks
Pannaria leucosticta	Oaks
Parmeliella microphylla	Sandstone
Parmeliopsis ambigua	Pines
Peltigera canina	Soil
Peltigera polydactyla	Soil
Pyxine sorediata	Moss
Sticta weigelii	Sandstone
Usnea mutabilis	Oaks

The location of the Howard College Natural Area in the Valley and Ridge Province adjacent to boundaries of the Piedmont Upland and the Coastal Plain makes the cataloging of lichens in the area of interest not only as a checklist for use of other workers in the Area but also in distribution studies of the various species.

ACKNOWLEDGEMENTS

Preliminary aspects of this work were greatly assisted by a grant from the Alabama Academy of Science for which appreciation is herewith expressed. Dr. Mason E. Hale and Dr. I. Mackenzie Lamb were very helpful in giving advice and in verifying the specimens.

LITERATURE CITED

Hale, Mason E. Jr. and William L. Culberson. A Second Checklist of Lichens of the Continental U. S. and Canada. Bryologist 63(3): 137-172, 1960.

Johnston, William D., Physical Divisions of Northern Alabama. Geological Survey of Alabama, Bulletin No. 38, 1930.

Mohr, Charles, Plant Life of Alabama, U. S. National Herbarium, 1901.

Symposium on
ALABAMA'S GULF COAST AREA
THE GEOGRAPHICAL SETTING

by

J. ALLEN TOWER*

The Gulf Coast is an area of unusual interest in Alabama because it differs from the rest of the State in so many respects. Its coastal location facilities the development of recreation and fishing industries, and the port of Mobile provides Alabama with a door to the world. Settlement history and population types also provide unusual interest.

The two counties of Mobile and Baldwin lie in the lower coastal plain. On the Gulf Coast proper, normal erosional processes have developed the usual offshore beach backed by lagoons, features typical of the coast of the South. In Mobile County, the bars are represented by Dauphin and Pelican Islands, the lagoon by Mississippi Sound. In Baldwin County, the offshore bars have been attached to the mainland, but the lagoon zone is still represented by Little Lagoon, the Shelby Lakes, and Perdido Bay. The broad but shallow Mobile Bay extends some 30 miles inland to the maze of distributaries and flat marshy islands of the delta of the Mobile River. The bay has a "drownded" coast, for the sea has invaded the lower parts of the valleys, creating much marsh and swamp. Only along the east coast for a few miles near Daphne and Fairhope does the upland touch the bay in bluffs, in places 100 feet high. In both counties the sandy upland rises slowly from the sea level in the south to some 300 feet altitude in the north. In Baldwin County, stream divides are broad and flat, but the landscape becomes hilly near the streams, which have usually cut their channels 50 to 100 feet below the upland level. In Mobile County the pattern differs slightly. The flat to undulating "flatwoods" plain extends inland from 3 to 7 miles from the sound and the bay; much marsh and swamp has developed here where altitudes are under 50 feet. On the inland side is a jagged escarpment from 25 to 100 feet high which marks the rise to a higher plain

* Before Dr. Tower's untimely death he requested that these papers be published as a symposium.

stretching northward into the Pine Hills. In both counties streams typically have broad marshy bottomlands.

It was in this low sandy landscape, with its longleaf pine uplands and its marshy bottoms covered with sedges and hardwoods, that the first white settlement came in Alabama. The first settlement of Fort Louis was made by the French in 1702 on the west bank of the Mobile River at Twenty-seven Mile Bluff, but in 1711 it was moved to the present site of Mobile. Although the colony never included more than about 800 people at a time in colonial days, it began the foreign influence which has continued in this region.[1]

After the annexation of this area in 1813 by the United States, the region long remained little developed except in the port of Mobile. In antebellum days Mobile grew rapidly as Alabama's cotton port, and was the largest city in the State in 1860 with 29,258 people.[2] Elsewhere in the two counties there were a few people in the fishing communities of Bayou La Batre, Coden, and Bon Secour. The upland was used for some production of lumber and naval stores, and for open range grazing of livestock. There was only a little agriculture, mainly in the Mobile River bottoms. During the rest of the 19th century, the population and economy of the area grew very slowly. The port of Mobile suffered from a shift of cotton to railroad transportation, so the primary growth factor became the expanding lumber business. Agriculture remained a minor factor. Creoles produced some truck crops for the local city market, and by the 1880's developed a small surplus for regional export, but agricultural growth was not significant until sparked by the colony boom.

In Baldwin County in the late 1880's there began a series of colony settlements which acted as a spark for regional agricultural development. These colonies, in part, seem to have been influenced by the lumber business with its available cutover lands. There have been about 13 of these colonies, most with a racial or religious basis, but one with a very interesting economic basis. The oldest colony is apparently that at Belforest, 1½ miles east of Daphne, founded in 1888 for Italians. A Swedish colony was started in 1894 at Silverhill, composed mainly of Swedes and Norwegians from the Middle West; this began on a 1500-acre tract, which has since been enlarged. Bohemians settled in many places in the county, but made their largest settlement about 3 miles southwest of Silverhill, where they still have a community center (Bohemian House). Largest of all, and one of the oldest, was the German

colony at Elberta; they and their descendants still dominate that area. North of Perdido is an extensive scattered group of Croatians organized around the Croatian Federal Union for social and marketing purposes. Seven miles east of Robertsdale was the French colony of Elsanor, and in 1906 a Polish one was begun near Summerdale. In 1907 Joseph Malbis founded a communal Greek colony at The Plantation (now called Malbis) 4 miles northeast of Daphne; all lived in a single house and pooled their earnings. There is now a fine dairy and nursery, and in Mobile the Malbis bakery and restaurant. A Russian Jew colony was founded in the north end of the county near Bay Minette. Four colonies were founded for religious purposes. A small Quaker colony was located about 1½ miles east of Fairhope, and a Friends Meetinghouse is still there. A Mennonite group settled at Magnolia Springs about 5 miles west of Foley on the Magnolia River, and in 1936 about 3,000 more settled between Foley and Summerdale. There is also an old Amish colony near Bay Minette. Fairhope is an economic colony founded in 1894 by E. B. Gaston and others from Iowa to practice Henry George's single-tax idea. The Fairhope Single Tax Corp. was incorporated in Alabama to handle their some 4,000 acres along the bay and to lease it for development. This corporation is still operating, and Fairhope has long been the most noted single tax community in the world.

Over the years many of the people in these colonies have moved away or died, but there is still a definite non-Southern flavor in much of southern Baldwin County. Largely through this colonization the county's population doubled between 1890 and 1910; it doubled again by 1950, based mainly on the development of specialty agriculture. Over in Mobile County agricultural growth has been influenced by that in Baldwin and in the city, but has been more a matter of individuals coming in attracted by the booms in truck crops and speculative fruit developments, especially Satsuma oranges, pecans and tung nuts.[3]

Population growth continues in this region. Only 22 Alabama counties had population increases during the 1950's. Mobile, with 36 per cent increase, ranked third, being exceeded only by Madison and Dale where the Army's Redstone Arsenal and Fort Rucker brought in many people. Baldwin, with an increase of 19.7 per cent, ranked also behind the two urban counties of Montgomery and Calhoun (Anniston); it therefore had the highest rate of growth of any non-urban or non-defense county in the State.[4] Likewise, this growth has not been caused by a Negro influx;

while Mobile County's percentage of colored population is just above the State average of 32.1 in 1950, concentrated mainly in the city, in Baldwin the population is under a quarter (22.5%).[5]

There are several growth factors in this region. Agriculture has been of major importance in Baldwin; this will be discussed in the next paper in this symposium by the county agent, Mr. Turner. Industrial growth has probably been the dominant force in Mobile; this will be considered in the fourth paper by Mr. Riggs of the Gulf, Mobile, and Ohio Railroad. Three other factors of some significance are the fishing and recreation industries, mining, and the development of the port of Mobile.

The fishing industry is a $4 million annual business.[6] The Creole element is strong in the fishing communities of Bayou La Batre, Coden, Alabama Port, Heron Bay, Cedar Point and Mon Louis in Mobile County, and in Bon Secour and Lagoon in Baldwin. People in these communities know each other better than they do people in nearby farm centers; they visit back and forth. There are probably over 1,200 commercial fishermen, plus over 600 others working in the seafood shops and canneries. The annual shrimp catch is on the order of 25,000 barrels, while the oyster catch fluctuates between 25,000 and 100,000 barrels, dependent upon the status of river floods and sewage pollution. In addition, there is the salt-water fish catch, even including red snapper from the Yucatan Banks off the Mexican coast.

Recreation is an industry of growing appeal. Flowers, especially the azalea and the camellia, were planted in Mobile originally for local appreciation, but their interest has now been expanded to attract visitors. The annual Azalea Trail and the perennially attractive Bellingrath Gardens attract several hundred thousand people each year. While the poet justly wrote, "A thing of beauty is a joy forever; its loveliness increases.", the city of Mobile has found that beauty is a material asset. The old homes and the Mardi Gras also attract visitors. The appeal is shown by the surprising number of motels lining U.S. Highway 90 west out of the city. Sportsmen are attracted also by the annual fishing rodeos. On the coast, cottage and resort development is expanding rapidly. The bridge built in 1955 opened up Dauphin Island, while the more favorable shoreline of Baldwin County has had greater cottage development on both the bay and the Gulf coast.

Mining in Mobile County means petroleum. In 1955 an oil pool was brought in at Citronelle, the only really good pool in the State. Now there are over 250 producing wells, and State oil production

has trebled, to nearly 7 million barrels in 1960. To the north in Washington County, a salt dome has contributed much to the growth of Mobile's chemical industry since 1950.

Lastly, and of fundamental importance, has been the growth of the port of Mobile. In 1928 it ranked 24th in the United States in foreign trade tonnage; in 1947 it ranked 6th.[7] Traffic continues to expand. This changed status is primarily the result of the opening of the Alabama State Docks and Terminals in 1928, with an initial investment of $10 million. Later expansions have approximately doubled this investment. The ship channel is maintained by the Army Engineers, with a currently authorized depth of 40 feet in the bay and 42 feet over the bar. Growth of Birmingham and increased use of the Warrior-Tombigbee Waterway have helped foster port growth.

The status of the Gulf Coast region is well illustrated by per capita income figures. In 1957 Mobile County's $1,642 ranked it third in the State, behind Jefferson's $1,998 and Etowah's 1,707. Baldwin's $1,140 rated it 18th, just behind the urban and industrial counties.[8] Rapid and prosperous growth is therefore typical of the Gulf Coast area.

LITERATURE CITED

1. C. G. Summersell: *Mobile, History of a Seaport Town,* Univ. of Ala. Press, 1949, *passim;* Edward L. Ullman, *Mobile: Industrial Seaport and Trade Center,* Univ. of Chicago Press, 1943, 9-16.

2. Weymouth T. Jordan: "Antebellum Mobile: Alabama's Agricultural Emporium," *The Alabama Review,* July 1948, 180-202.

3. Ullman: *Op, Cit.,* 20-24; Roland M. Harper: *Resources of Southern Alabama,* Geol. Sur. of Ala., Spec. Rept. 11, 1920, 72-76! W. E. Tharp and others: *Soil Survey of Baldwin County, Alabama,* Gov. Printing Office, 1911, 8-12; B. H. Williams and thers: *Soil Survey of Mobile County, Alabama,* Gov. Printing Office, 1936, 6.

4. U.S. Census of Population: 1960. *Number of Inhabitants. Alabama.* (PC (1) -2A).

5. U.S. Census of Population: 1950. Vol. II. *Characteristics of the Population,* Part II. *Alabama,* Table 12.

6. "Alabama's fishing industry tops $4 million annually," *B'ham News,* 19 March 1961.

7. Summersell: *Op. Cit.,* 63-64.

8. Marion H. Hawley: *Personal Income in Alabama Counties Since 1939,* Univ. of Ala. Bur. of Business Research, Printed Series 25, 1959, 22-23.

BALDWIN COUNTY'S AGRICULTURE AS TAKEN FROM COUNTY AGENT'S REPORT 1959-60

F. C. TURNER

County Agent

When you mention "Baldwin County, Alabama" you are covering a lot of territory. It is the biggest county in Alabama, with over 600 miles of water frontage and beaches which ranks it among the finest on the Gulf of Mexico. From Little River on the north to Gulf Shores on the south, the county measures approximately 100 miles.

Baldwin County's 1,021,320 acres are devoted to farms and forest lands. Actually hardly more than ten per cent of the county's total area is in cultivation for crops, the other 90 per cent representing forest lands, lakes and rivers. The land, according to a recent survey, is divided among some 3,251 farms and timber tracts of which 2,271 are fully owned by their operators, while 351 are partly owned and 336 are operated by tenants who rent mostly for cash.

One of the major factors in Baldwin's success is its soils. Varied, rich and fertile, these make for the widest possible production of early vegetable crops, mainly Irish potatoes, corn, cucumbers, melons, and others. Topographically Baldwin County is level to gently rolling. The soil types vary from deep sand to deep red lands with good clay subsoil. All these soils except the deep sands fringing the Gulf are highly productive.

Another important agricultural factor is Baldwin's ideal climate which is mild and humid. The county averages a growing season of 300 or more days a year, 60 inches plus of rainfall annually, and a mean temperature of 67 degrees.

The population of Baldwin County is approximately 50,000 with over 80 per cent of the total population rural. It is highly cosmopolitan—representing more than 25 different nationalities.

The county's agriculture is very highly diversified, with 25 or more cash crops. It is also highly mechanized—with tractors, combines, potato diggers and planters, corn pickers and other modern means of handling farm produce throughout the county.

Farm income is larger in Baldwin than in any other rural county in Alabama, and exceeds some of the state's other counties

as much as seven times over. A summary of crops grown in a recent year and the income received is as follows:

Timber	$7,000,000	Hogs	$600,000
Irish potatoes	3,500,000	Pecans	300,000
Soybeans	3,500,000	Miscellaneous truck crops	500,000
Dairying	5,000,000	Seed and small grains	700,000
Beef cattle	1,500,000	Poultry	1,000,000
		Flowers, bulbs, etc.	1,000,000

Agricultural markets have played a very important part in the development of Baldwin County. At present there are 21 privately owned packing sheds in the county which are engaged approximately 7 months per year. There are 6 co-ops in the county which ship produce for the farmers. The county is extremely fortunate in being located directly between Pensacola on the southeast and Mobile on the west. These cities provide a good outlet for poultry, dairy products and fresh vegetables.

Information On Baldwin County's Timber Resources

The following information was obtained from the office of the District Forest Ranger, Mr. Knox Davis, of Bay Minette.

There are 775,700 acres of forest land in Baldwin County at present. The tree species on this forest land are principally longleaf and slash pine. There are very few, if any, hardwood stands within the pine stands. Most of the pines in Baldwin County are grown on hill sites while approximately 90% of the hardwoods are located on the various streams and in swamp lands.

Back as far as 1946 Baldwin County produced 144,628 cords of pulpwood and more than 35 million board feet of lumber. This figure has not changed appreciably up through 1958. It has thus been rather constant since about 1946.

In recent years numerous seedlings have been used to re-stock some of the cut-over pine lands of Baldwin County. To give some idea of how much re-stocking is done on an annual basis, in the 1959-60 season 8,969,884 seedlings were planted. The International Paper Company has established a nursery in Baldwin County for the production of seed. This nursery consists of about 40 acres

planted to selected pine seedlings which have been grafted using scions from outstanding seed producing trees in Florida and other sections. This nursery was established about 4 years ago.

The growing season in Baldwin County is longer than in any other section of Alabama. There are about 300 days in which forest trees can make very good growth. In addition to the extremely long growing season, Baldwin County is very fortunate in having 60 inches plus rainfall per year. This is extremely helpful in the production of timber. Timber markets are readily accessible and this has encouraged timber production in the county tremendously. Two of the largest paper mills are located in Mobile and one other is located in Pensacola. In addition to these mills, there are numerous veneer mills, cross-tie mills, box mills, and pole and piling mills.

In the last 10 years the production of turpentine has decreased until at present there is not a turpentine still located in Baldwin County. Most of the crude turpentine and stump wood coming from this area goes either to Mobile or to Pensacola to be processed.

SOIL AND WATER CONSERVATION IN THE GULF COAST REGION

WILLIAM T. BROWN

Soil Conservation Service
Mobile, Alabama

My statements about soil and water conservation in the Gulf Coast Region are based upon my experiences as a Work Unit Conservationist for the Soil Conservation Service in Mobile County over the past ten years. Some of the facts about this county apply to Baldwin County also.

It is interesting to consider the types of farming practices carried on in the county and note how some have passed out of the picture or changed over the years. We no longer see large groves of satsumas as we did at one time. The cabbage farmer, along with the two-wheeled cabbage cart, has faded from the picture.

Tung orchards that sprang up so rapidly during World War II years are gradually being bull-dozed out and planted to pasture or other crops. Some cotton is still grown, but not much.

Many acres of land are cleared each year and planted to melons. The land is then planted to pasture. Many farmers grow soybeans as a cash crop. A potato chip factory from Wisconsin has bought land in Mobile County to grow potatoes. They plant about a thousand acres of potatoes each year and ship them to their factory at Madison.

Beef cattle farming has increased in recent years. Dairy farming has increased some. Nurseries are big business in this area and continue to increase in size.

Along the southern part of the county we have our wet flatwoods area. Full development of this area depends on proper drainage. Thousands of acres of good Classes I and II row cropland have been planted to pine trees in the past five years.

The changes that take place in our methods of farming are always accompanied by some problems. We will all agree that over the centuries man has tended to upset the balance of nature wherever he has been. He has exploited the natural resources at his disposal until problems eventually arose.

This was the case in the early 1930's. This was the picture on the land when the late scientist, Dr. Hugh Hammond Bennett, came along. Wellington Brink, author of "Big Hugh," wrote in the October 1960 issue of the Soil Conservation magazine: "In what is but the flicker of an eyelid on the face of Time, Hugh Bennett was able to halt and reverse the exploitative trend on American farms and ranches, and to stay the hand of ruin in many another nation brought low by ruthless plow, hoe, fire, and axe."

In 1935 Congress passed the Soil Conservation Act. Under the inspiring leadership of Dr. Bennett, men who loved this great country of ours went to work. They had decided that they wanted to protect their land and water resources. No man in Washington wanted to order all the people to apply modern conservation measures to the land, so Soil Conservation Districts were organized freely and voluntarily to do the job according to the principles of self-government in watersheds, counties, and communites all over the country.

The Mobile County Soil Conservation District holds monthly meetings. The district supervisors discuss ways of getting more landowners to apply more sound soil and water conservation practices to the land.

Now, we look about us here in the gulf coast and see deep gullies wrapped up with kudzu or other-conserving plants. Now, we know how to control them with vegetation or gully control structures. We see beautiful farm ponds in natural draws on land that was considered useless at one time. These ponds furnish water for irrigation, livestock, fire protection, fish for the table, and swimming and boating for the family. We look further to the hills that were once made bare by fire or the farmers axe and see young planted pines reaching up for the warm Gulf Coast sun, and drinking freely of the more than 60-inch annual rainfall.

We see farmers and sportsmen joining hands in a cooperative effort to plant food for wildlife. Soil and water conservation education is fast becoming a part of our children's education and Boy Scouts all over America are putting conservation projects on the land as a part of their total scouting program.

The progress we have made in the field of soil and water conservation is on the land today for all of America to see. Foreign countries send men here to see and receive training. A young man from the Island of Cyprus spent two months here in Mobile County and another from the Philippines spent two weeks here.

The trend in soil and water conservation over the past 25 years has been steadily upward. This has been very pleasing to dedicated conservationists. But, where do we go from here?

The goal of the Soil Conservation Service is to help every landowner, through his local soil conservation district, to conserve his soil and water resources. The systematic approach is made through a basic soil and water conservation farm plan. The first step is to get an inventory of the soil resources on the farm. A soil scientist will make a soil survey on an aerial photograph. This will show the farmer the kinds of soils, the slope of the land, and the amount of erosion on his farm. It will also show the present land use.

The farmer's decisions as to how he plans to use each acre to get the best returns will be recorded on a conservation plan map. It will show him what each acre needs to keep it from eroding and to make it produce. These plans are flexible and may need changing or revising as new conservation plants or methods are developed.

The local Soil Conservation Service workers help the farmers apply the planned practices to the land. We show him how to maintain erosion control structures. We help him manage the soil-conserving crops so they are improved from year to year.

We of the Soil Conservation Service have tried to look beyond today and the progress we speak about because we realize the job is far from complete. We have tried to look 15 years hence to 1975 and see if we can calculate the potential work load of conservation practices that will need to be put on the land in the Gulf Coast Region.

To continue this upward trend in the application of conservation, practices to the land, Mobile County alone will have to build 29 miles of terraces each year, establish 29 acres of vegetated waterways, plant 1,500 acres of improved pasture, do 7,650 acres of woodland improvement, build 5 miles of drainage ditches, and establish 1,900 acres of conservation cropping systems.

Many things that are good for America do not come easy. Progress in reaching our soil and water conservation goals in this area will be hampered by sandy soils that erode quickly during our high intensity rainfalls. Part-time farmers living on the farms and working in the city are difficult to help. There is still a great deal of misunderstanding and lack of interest in good conservation practices that can be applied economically and profitably to the land.

One of the new tools of conservation that is being used by landowners in this area is parallel terraces. This is a new method of terracing brought about by the use of heavy machinery on the farm. Parallel terraces eliminate short rows.

The use of grass-based rotations is increasing. Land that has been planted to grass and clovers for several years is turned under and planted to row crops. These rotations reduce run-off, add tons of organic matter per acre, and bring back life to the soil. They are being widely accepted by the local nurseries. Vegetated field borders are used for farm roads and turn-around areas for big farm machinery. They provide food and cover for wildlife too.

Bahia grass has advanced from a "so called" pest to the most popular grass of the Gulf Coast Region in the past 15 years. Its tenacious root system makes it the most valuable perennial erosion control plant in this area. As some farmers say, it's a natural for gulf coast sand and climate. It provides valuable pasture for beef cattle, and dairymen use it to pasture dry cows and heifers.

Ball clover has been planted by several district cooperators. Each year it looks more promising. Its ability to grow and reseed on light soils makes it an important conservation plant for this area. Some stands have reseeded for two years. Each year they seem to get better.

Coastal salt marshes can be diked for successful brackish water duckponds. We can suply winter food and resting areas rather than summer food and nesting cover.

The importance of soil and water conservation, as well as the conservation of our natural resources, must be understood and accepted by all people, whether on the farm or in the city. People must be made to realize that our soil is our strength. Man may be projected into outer space, but before long he will return for more food. Food that will come directly or indirectly from the soil.

Dr. Bennett wrote in the 1950 Soil Conservation Magazine, "all the conservation science in the world will not get one acre of privately-owned land in this country protected against erosion, drained of excess water, or used in accordance with its physical capability unless the landowner wants it done and knows why he wants it done."

So, the future progress in soil and water conservation in the Gulf Coast Region will be dependent upon its acceptance by the total public. Conservation never has been and never will be a one-man project. It will take the help of the Alabama Academy of Science, all our school teachers, Boy Scout leaders, 4-H Club leaders, Vo-ag teachers, our ministers, and others.

YESTERDAY in the history of this strip of land along the coast, is gone forever. We only have the remembrance of successes or failures. TODAY, we hold in our hands success and control. We can do something about soil and water conservation in the Gulf Coast area today, and we are. TOMORROW is something to look forward to with anticipation for we know not what it brings. What we do will greatly influence what tomorrow brings.

INDUSTRIAL DEVELOPMENT OF THE MOBILE AREA

WILLIAM A. RIGGS

Engineer, Resources and Industrial Development

Gulf, Mobile and Ohio Railroad Company

Possibly, a better perspective on the industrial development of the Mobile area may be gained by taking a moment to examine a few generalities of industrial location and economic geography. It might be well to remember the story of the engineering professor who asked his students why one of our major railroad lines was constructed. The answers were various, including, "To provide economical transportation"; "To take advantage of the best line and grade"; "To help develop our great nation"; and they were all incorrect. The correct answer was that the railroad was constructed to earn dividends for its stockholders. Another variation on this same theme is the plant location, design and construction firm which, for many years, advertised, "What we really engineer is black ink."

There are two principal ways of earning dividends, either by obtaining higher prices for the product, a difficult task in this competitive age, or by decreasing the cost of production and marketing. The cost reduction approach allows two choices; technological improvement resulting in greater productivity at lower cost; or careful selection of a manufacturing plant location where all the factors of production may be assembled at the least cost and from which the finished product may be delivered to ultimate markets at the least cost. At times, technological improvement and plant location can be combined to achieve the lowest unit costs for manufacturing and distribution, such lowest unit costs being always the ultimate goal.

It is generally possible to resolve many of the initial problems of site selection by map studies, using national or regional outline maps as bases on which to plot sources of raw materials, energy, water, etc., as well as markets, each with applicable costs, sometimes even in isopleth or cost contour form. Study and correlation of such maps will permit the elimination of many grossly unfavorable areas and reduce the number of areas for field examination and detailed cost calculation. For final site selection there is no substitution for detailed unit cost estimates.

Generally, the durable goods industries are fairly critical of

location and this situation is becoming more significant as we find ourselves drawn more deeply into the "profit squeeze" phase of our current business cycle. On the other hand, the non-durable goods industries, particularly those of medium to high labor cost and high valued, but compact products, can successfully operate nearly anywhere. Quite a competition has arisen, with communities offering one form or another of legitimate assistance or even outright subsidy to capture these non-durable goods payrolls and with the industries themselves "shopping" one town's offer against the next, trying to squeeze out the last drop of advantage. Fortunately, to my best knowledge, Mobile has never yet entered such a contest.

Many of the long established industries, especially in the East and the Midwest, were located by chance . . . somebody with a process or an ability set up a factory where he lived and it grew like Topsy. Interchange of skilled labor or partially finished materials or components led to traditional centers as the Connecticut River Valley for hardware, Massachusetts for writing paper, and Trenton, Syracuse and East Liverpool for China. These traditional centers are now gradually disappearing.

Some industries may be classed as raw materials oriented, such as copper smelting and refining, where cost of raw materials accounts for 91% of the value of the product; meat packing, 84%; cigarette and other tobacco manufacture except cigars, 78%; and cane sugar refining, 76%. These industries are typified by their low percentages for wages, 6% in the case of meat packing being the highest, and by considerable volume reduction from raw material to finished product. Generally such industries locate near raw material sources.

Other industries may be classed as market oriented since cost of getting finished goods to market and/or the need of beating the competition to market in time and service. Most market oriented industries make direct consumer products such as prepared foods and drinks, containers, building materials and assembled automobiles. Many of these industries show volume gain and sometimes weight gain over their raw materials.

Labor oriented industries generally have low to medium raw material costs but high labor costs as in pottery and china where labor cost represents 48% of value of product; hosiery, 36%; shipbuilding, 32% and machine tools, 28%. Labor oriented industries have often been located near the traditional centers.

Finally, there are the few energy oriented industries, all in-

volving chemical processes, usually electro-chemical in nature. Typical industries of this type are always located near low cost energy sources, such as calcium carbide where energy cost represents 37% of the value of the product; aluminum, 26%; and electrolytic zinc refining, 22%. Prior to the 20th Century the water wheel located many industries alongside mill streams and then steam and internal combustion engines and finally electric power greatly broadened the site selection possibilities.

Compared with other cities of its general size, Mobile has reasonably well diversified employment, with only about 27% of its total wage earners engaged in manufacturing. Government facilities, including Brookley Air Force Base and the Corps of Engineers, provide the largest single employment classification (nearly 10% of the total) in Mobile County. Retail trades, other than foods, follow closely with about 9½%, then shipping with about 7%, construction with about 6½%, and wholesale trade with about 4%. Principal manufacturers are, in order of employment, shipbuilding, lumber and wood products, food and kindred, pulp and paper, and chemicals. It should be noted that much of the recent chemical industry development is at the McIntosh salt dome in neighboring Washington County.

Generally in percentage of total employment, the State of Alabama is heavier in manufacturing than is Mobile County, particularly in textile mill products, primary metals and lumber and wood products. On the other hand, Mobile County is heavier than the State in shipping, government employment, wholesale and retail trade, and finance, insurance and real estate. However, in recent years Mobile has made progress in developing from a city of tradesmen or storekeepers into more of an industrial city. Percentagewise, this gain in industrial employment has been greater than that experienced by New Orleans.

It may be interesting to compare Mobile with cities of similar size where about ⅔ of all employment is in manufacturing, such as Flint, Michigan (automobiles), and Bridgeport, Connecticut (machinery and miscellaneous manufacturers); or where about 37% is in manufacturing as in Wichita, Kansas (aircraft) and Charleston, West Virginia (chemicals). In the 27% manufacturing category with Mobile are Des Moines, Iowa, (miscellaneous manufacturers, finance and retail), and Albuquerque, New Mexico, (miscellaneous and construction). Most state capitals fall in the 20% industrial class including Sacramento, California, (public administration), and also including Jacksonville, Florida, (public adminis-

tration and railroads.) Cities having only 12% manufacturing, rather hard to find, include Atlantic City, New Jersey, (hotels) and Pensacola, Florida, (public administration), both of these cities being smaller than Mobile.

Using hindsight and a little behind the scenes knowledge, it is possible to reasonably well pinpoint the major factors in the locations of the existing industries in Mobile. Shipbuilding naturally followed the port, and evidently price and quality of work, especially repairs and conversions, has been good enough to attract business from other ports to Mobile. Lumber, wood products and pulp and paper all came to utilize available local raw materials, and, in addition, pulp and paper needed vast amounts of water, both for processing and to dilute the voluminous liquid wastes. The rayon plant had similar water and liquid waste problems. The alumina plant was raw material oriented, locating at a transhipment point for imported bauxite, and it also had a waste disposal problem, even though not a liquid one. The portland cement plant was a chance outgrowth of alumina manufacture, whereby the local raw materials, reef shells, and clay, could be processed into portland cement in a converted wartime soda-lime sinter alumina plant abandoned as uneconomical for peacetime operation. Many of the chemicals are based on salt produced as brine from a large salt dome luckily situated at navigable river's edge, and nearly all of the chemicals find substantial markets in local industry, especially pulp and paper and rayon. Like any government project, the origin of Brookley Field would be difficult to pinpoint, but, at least it started with a large municipal airport situated adjacent to deep water navigation.

It is interesting to speculate as to whether or not the pattern for industry may have already assumed its final form in Mobile. That is, will expansion of industry types already located in Mobile, ultimately provide greater employment growth than may be provided by new industry types yet to locate in Mobile? Evidence in support of this thought is provided by a rough study of the five large industries which located in the Mobile area between 1928 and 1938. The initial operations of these industries provided total employment of approximately 2,285. Today these industries employ a total of approximately 6,675, every one of them having more than doubled in employment, and one of them having quadrupled. The industries involved are paper, building materials and alumina. Four of the largest industries which located in the Mobile area between 1946 and 1953 employed a total of approximately

770 in their initial operations, and have now grown to a total of approximately 1,025 employees. The industries involved are building materials, chemicals and textile fibres. Neither example represents all of the new industries established in this period, although the examples do cover the major employers.

Possibly Mobile's greatest industrial asset is a vast supply of local surface water of high quality, developable in large quantities with cost and quality competitive to ground water. In addition, there is the water of the Mobile River system, requiring desilting and transportation from a non-saline intake point about 25 miles upstream from Mobile. Fortunately, Mobile already has organizational means of developing these water supplies when needed.

The port with its terminal railroad and bulk material and general cargo handling facilities are assets, as are the extensive networks of all types of transportation facilities. Shipyards, steel fabricators, foundries and machine shops provide excellent maintenance facilities as well as possibilities for sub-contracting production work. A variety of alternate transmission lines and primary sources assures almost unsurpassable continuity of electric power and natural gas service. Good industrial sites having access to waterfront or dock facilities, if needed, as well as to railroad and highway transportation are available at realistic prices. While there may be some problems regarding Alabama Industrial Development Association property and the Theodore Ammunition Depot property, such problems represent nothing which having a bona fide customer immediately at hand could not provide incentive for curing quite rapidly.

Construction costs are substantially lower than northern or eastern costs for comparable facilities, although it must be admitted that Mobile construction cost averages are not the lowest in the South, not even among the big cities. Fuels for industrial use are available at moderate costs, with both water borne Alabama coal and natural gas available at about 28 cents per million BTU for large users. Prices for smaller gas loads and for rail delivered coal are somewhat higher, but still reasonable. Extremely large users of coal can probably better the 28 cents figure for some time to come. In all, while natural gas prices are not positively cheap and thus may limit possibilities for industries using natural gas as raw material, the general fuel picture is attractive for a port city. Electric power is moderately priced and available in large quantity with extremely good service continuity.

Much has been said of the industrial expansion possibilities

attendant to improvement of the Tombigbee-Warrior Waterway and the proposed Alabama and Tombigbee-Tennessee waterways, and these projects will undoubtedly contribute to the growth of Mobile. However, their importance should not be overestimated. Two stub end waterways serving fairly thin territory and one waterway climbing by a series of locks over a significant divide can hardly be calculated to draw tremendous amounts of business and industry away from the great Mississippi River system which springs like a tree from New Orleans. The recent talk of Vicksburg becoming a port for ocean vessels carries quite a threat.

In the opinion of the writer, some of the most likely potential new industries for Mobile would be those based on salt transported and produced as brine from salt domes about 65 miles inland. The salt derived chemicals could be distributed by both inland and coastal transportation. An economic cutoff would be provided, however, by the possibilities for production of similar chemicals from offshore salt and Louisiana salt. An oil refinery might be justified by increase of Citronelle field oil reserves, but it is unlikely that it would ever atttain sufficient size to produce any petrochemical feedstocks. A sugar refinery has been talked of for years and may now be approaching reality. There might be possibility for transhipment point production of ferroalloys based on imported ores but not requiring electrometallurgical or blast furnace reduction operations.

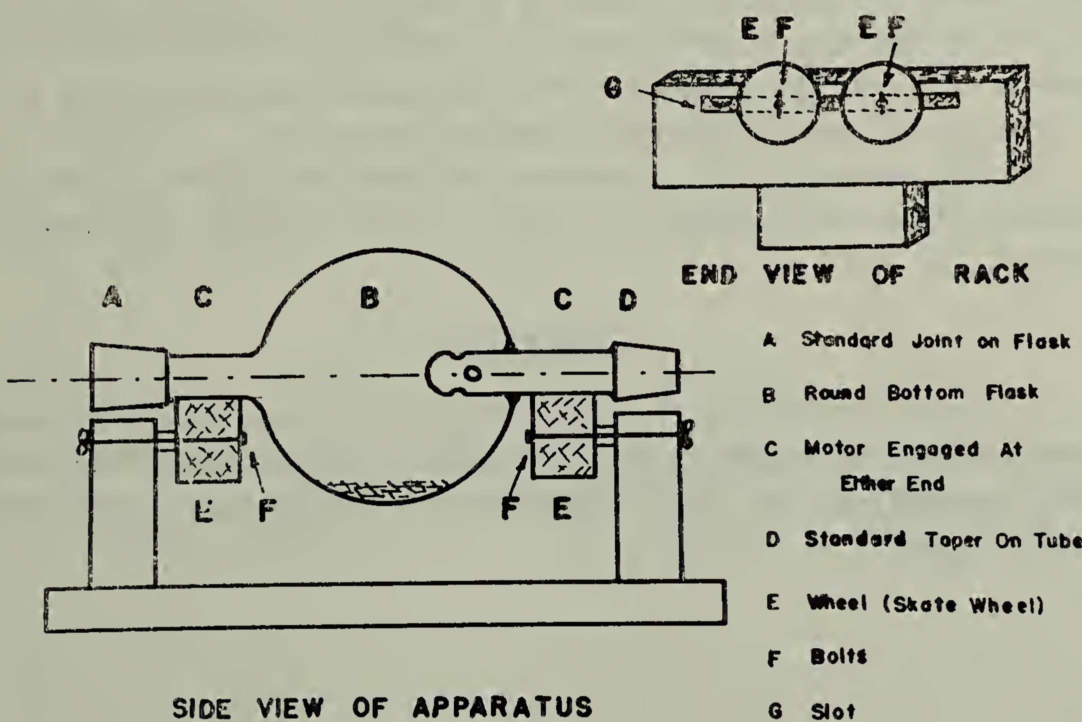
Pulp and paper and converted paper products should expand, as should all wood using industries. There are possibilities for new and expanded industries based on nearly all consumer goods designed to sell in both local area domestic markets and in coastal and export markets.

A Simple Device for Saturating Blood with Gases

WALTER H. JOHNSON

University of Alabama Medical Center, Birmingham, Alabama

The apparatus consists of three parts: 1. The glass container with sealed tube, 2. the wooden frame with attached rollers (or rack) and 3. the motor (variable speed). The glass container is easily fabricated from a round bottom pyrex flask, by sealing a pyrex test tube (16 x 150mm.) through the bottom. The use of a pyrex ground joint with a standard taper in place of the test tube and a pyrex flask with a standard joint makes the apparatus more versatile. If holes are blown in the bottom of the test tube then the apparatus can be used either as a trap or as an evaporator. If the standard taper joint is used, it will be necessary to seal off the plain end before blowing a few holes near the end of the tube.



The actual steps in fabrication consist of blowing several small holes in the side of the test tube near the sealed end. The tube is then fitted into position by using a ring seal at the bottom of the flask. The tube should extend into the flask about ⅓ the diameter of the flask. The supports consist of wood. Bolts which hold the wheels are attached to the supports through a slot so that they can be adjusted to produce maximum operating efficiency. The wheels can be made from either wood or plastic;

however the best results are obtained from the use of ball bearing wheels. These can be obtained from old roller skates.

The supports of the frame are fastened to a base of wood. The wheels are then mounted on the supports thus forming a rack for mounting the flask. The motor (which has a wheel attached to its shaft) is placed so that the wheel rests against the sealed tube. Then the motor can be adjusted so that the speed of the revolving container will be about 1 revolution per second.

Gas can be passed through the neck of the flask from a tank or generator as the flask is rotated. The atmosphere in the flask gradually approaches saturation with the gas employed and the excess gas will escape through the openings.

If one desires to saturate blood with some gas such as either carbon monoxide or oxygen, blood is placed in the flask and the motor is started. Then the gas is fed into the flask by means of a small gas tube, which is inserted through the neck of the flask. Then when the flask is rotated, it carries a thin film of blood on the inside surface, which speeds up saturation with the gas. We have found that the apparatus not only speeds up saturation with the gas but it operates without further attention.

In case one is using a noxious gas such as carbon monoxide, he can set up the apparatus under a hood and let the reaction proceed.

SUMMARY

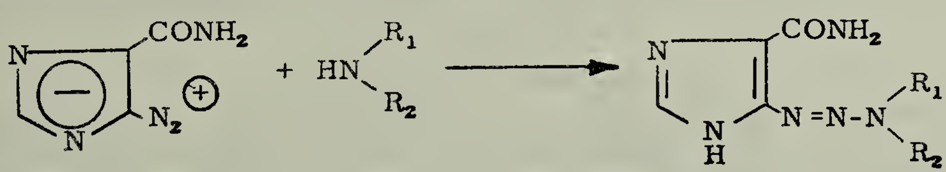
A simple device has been described which has been fabricated from supplies found in most laboratories. The apparatus has been used successfully in this laboratory for saturating blood with noxious gases.

Coupling Reactions of 5-Diazoimidazole-4-Carboxamide

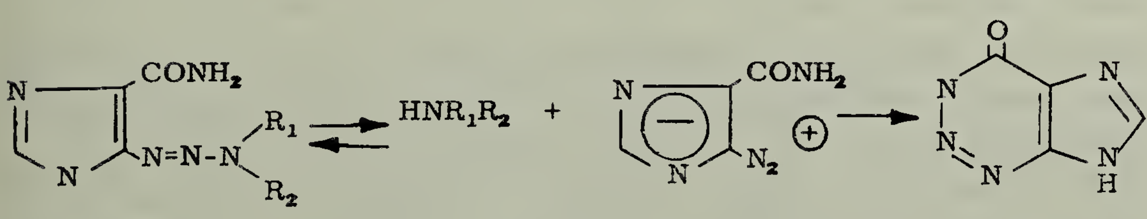
Charles A. Krauth, Y. Fulmer Shealy, and John A. Montgomery

Southern Research Institute, Birmingham, Alabama

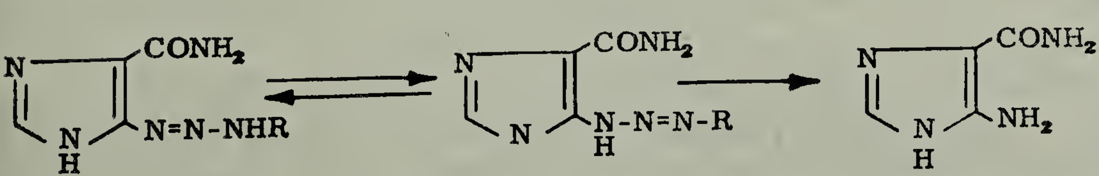
5-Diazoimidazole-4-carboxamide (I) has been shown to undergo coupling reactions typical of aromatic diazonium salts; azo derivatives have been obtained by employing the usual procedures for coupling with dimethylaniline and with 2-naphthol. Conditions have been devised for the preparation of triazenes (II) by coupling the diazoimidazole (I) with a variety of representative secondary and primary amines. The triazeno derivatives (IIa) of secondary amines are stable in solution in the dark. In the presence of light, they decompose via an equilibrium involving 5-diazoimidazole-4-carboxamide (I), the amine and the triazeno derivative (II)a. However, the diazoimidazole (I) is rapidly and irreversibly converted to 2-azahypoxanthine (III).



I II



IIa I III



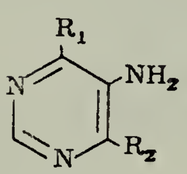
IIb IV

In contrast, the triazeno derivatives (IIa) of primary amines are unstable in solution in the dark. They dissociate to 5(or 4)-aminoimidazole-4(or 5)-carboxamide (IV) rather than to 2-azahypoxanthine (III).

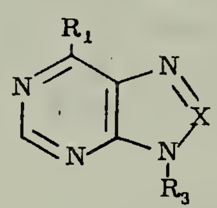
Some Reactions of 5-Amino-4-Hydrazinopyrimidines

Carroll Temple, Jr., J. A. Montgomery, Southern Research Institute, Birmingham, Alabama, and R. L. McKee, Department of Chemistry, University of North Carolina, Chapel Hill, N.C.

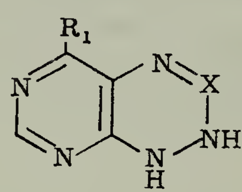
In our program to produce potential anticancer agents we have investigated the reactions of 5-amino-4-hydrazinopyrimidines [I, R_2=NH—NH_2] with several cyclization agents. In this system the introduction of a carbon atom to form a new ring involving the hydrazino group may proceed by one or more of three pathways [II (R_3=NH_2), III, IV, X=CH]. Previous work from this labora-



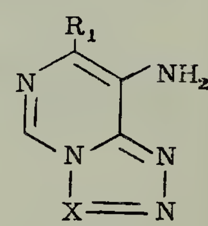
I



II



III



IV

tory [J. A. Montgomery and C. Temple, Jr., *J. Am. Chem. Soc.*, *82*, 4592 (1960)] showed that reaction of 5-amino-6-chloro-4-hydrazinopyrimidine [I, R_1=Cl, R_2=NH—NH_2] with either formic acid or ethyl orthoformate-acetic anhydride produced derivatives of 9-aminopurine [II, R_3=NH_2, X=CH]. Under the conditions employed we have now found that attempts to prepare 1,2-dihydropyrimido[5,4-e]triazin-5-ol [III, R_1=OH, X=CH] by cylization of 5-amino-6-(2-formylhydrazino)pyrimidin-4-ol [I, R_1=OH, R_2=NH—NH—CHO] gave only 9-aminohypoxanthine [II, R_1=OH, R_3=NH_2, X=CH]. This product could result only by migration of the formyl group from the hydrazino group to the amino group followed by ring closure to the 9-aminopurine.

The acid catalyzed reaction of I [R_1,=Cl, R_2=NH—NH_2] with ethyl orthoformate yielded, in addition to a small amount of 9-amino-6-chloropurine [II, R_1=Cl, R_3=NH_2, X=CH], either 5-chloro-1,2-dihydropyrimido[5,4-*e*]-*as*-triazine [III, R_1=Cl, X=CH] or 8-

amino-7-choloro-*s*-triazolo[4,3-*c*]pyrimidine [IV, R_1=Cl, X=CH]. Evidence will be presented in favor of the dihydropyrimido- [5,4-*e*]-*as*-triazine structure.

Treatment of I [R_1=Cl, R_2=NH—NH_2] with nitrous acid also offers three pathways [II (R_3=NH_2), III, IV, X=N] for ring closure with nitrogen. Structure II [R_1=Cl, R_3=NH_2, X=N] was eliminated since the ultraviolet spectrum of the product was quite different from that of 3-benzalamino-7-chloro-*v*-triazolo[4,5-*d*]pyrimidine [II, R_1=Cl, R_3=N=CH C_6H_5, X=N] formed by the nitrosation of 5-amino-4-benzalhydrazino-6-chloropyrimidine [I, R_1=Cl, R_2=NH—N=CH C_6H_5]. Present evidence favors the 8-amino-7-chlorotetrazolo[1,5-*c*]pyrimidine [IV, R_1=Cl, X=N] rather than the 8-chloro-3,4-dihydropyrimido[5,6-*d*]-tetrazine [III, R_1=Cl, X=N] structure.

Vortex Formation of Turbulence

A. E. Elkayar*
Auburn University

The flow of real fluids involves energy loss due to the frictional resistance of the fluid. The amount of energy loss due to turbulence can be partially predicted by empirical formulae. Increase in hydraulic machines efficiencies will be obtained after getting a complete study of the origin of vortex formation, transportation of potential energy to turbulence, momentum and vorticity transfer and the theory of turbulence vortices.

In the case of flow around a turn or a vane where turbulence changes from point to point, we must consider turbulence energy because it will be transformed into heat by an irreversible process. It is very difficult to get the exact mechanism by which turbulence is dissipated into heat.

Prandtl based his theory on turbulence on the conception of fluid particles momentum transfer, equation (1).

Taylor suggested the conception of vorticity transfer, which is based on the equation for the mean pressure gradient existing in the direction of (x_1) axis, equation (2).

Von Karman objected to the above theories because terms containing viscosity are negligible for large Reynolds numbers. He assumed that turbulent transport processes are determined by local

* Visiting Professor

flow conditions and suggested equation (3).

Later, Prandtl related processes by overall flow conditions. He suggested equation (4). Here the coefficient of eddy diffusion is constant. This contradicts Prandtl's theory on mixing length, where the coefficient of eddy diffusion was variable.

It was shown that transport of axial momentum is due to gradient type diffusion by small scale turbulence, whereas transport of turbulence energy is caused by convective action of large lump motion, and transport of heat is caused by the combination of both.

For dissipation of energy due to turbulence, the two laws given by equations (5) and (6) are used. In equation (5), the dissipation is given in terms of velocity fluctuations. In equation (6), it is given in terms of velocity gradients due to the fluctuations.

The mechanism and dissipation of turbulence are still far from being completely determined, and further studies are recommended.

Shear Stress:

$$\tau = -\rho\, \overline{u_1 u_2} + \mu \frac{du}{dx_2} \qquad (1)$$

where u = mean velocity of u_1

μ = viscosity of the fluid

ρ = density of the fluid.

$$\frac{d\bar{p}}{dx_1} = -\rho \frac{\partial}{\partial x_2} (\overline{u_1 u_2}) + \mu \frac{d^2u}{dx_2^2} \qquad (2)$$

Coefficient of eddy diffusion:

$$\epsilon = (\text{constant}) \frac{\bar{u}_2^2 \lambda g \rho}{\mu} \qquad (3)$$

where λg = local character of flow which is spatial lateral microscale.

$$\epsilon = (\text{constant})\, B\, (\bar{u}_{max} - \bar{u}_{min}) \qquad (4)$$

where B is the width of the mixing zone.

Dissipation of energy due to turbulence:

$$\overline{W} = (\text{constant}) \frac{\rho\, (\bar{u}^2)^{3/2}}{L} \qquad (5)$$

or, $$\overline{W} = 7.5\, \mu \left(\overline{\frac{\partial v}{\partial x}}\right)^2 \qquad (6)$$

Notes on Conchoids, with Special Reference to Those of the Ellipse

Roland M. Harper
University, Alabama

A conchoid, as conceived by the Greek mathematician Nicomedes, in the second or third century B.C., is the locus of a point a fixed distance (the modulus) from a given straight line (the directrix) along a straight line varying in direction but passing through a fixed point (the pole).

A complete conchoid consists of two curves. One (which we may call the outer) is on the side of the directrix away from the pole, and the other (inner) is on the side toward the pole. These run together at infinity, the directrix being the asymptote of both. The outer conchoid will always have a hump in the middle, something like a probability curve. The inner one will have a hump if the modulus is less than the distance of the pole from the directrix, a cusp if it is equal to the polar distance, and a loop if it is greater.

Since Nicomedes' time it has been decided that the directrix of a conchoid does not have to be a straight line, but can be almost any kind of curve. Most of the ovals and related curves described and figured in a paper that I presented to this section in 1956 could be called conchoids of a circle. At this time I will discuss mainly conchoids of an ellipse, and will make the matter as simple as possible by using only the most typical ellipse imaginable, with one diameter twice the length of the other. I will also put the pole on the longer axis, so as to avoid freak curves, which could be produced in infinite variety.

Let us start with the pole at the center of the ellipse. If we start with an outer conchoid, and make the modulus small, we get what looks like an ellipse of the same shape as the original one, but a little larger. If we extend the modulus the resulting curve looks more and more like a circle, and becomes a circle at infinity. But outer conchoids need not be considered further here.

Now let us take a series of inner conchoids, and start with a pretty short modulus. At first of course the resulting curve will be very much like the ellipse. But make the modulus equal to the distance from one of the foci to the end of the long axis, and the resulting curve will be straight for an infinitesimal distance where

it crosses the short axis, similar to if not identical with a curve produced by a plane cutting a doughnut-shaped ring at its thickest point, as described in my paper on lemniscates presented at the 1959 meeting (Annals, Vol. 31, p. 224). And this seems to be true regardless of the shape of the governing ellipse.

Make the modulus still longer, and the resulting curve will become pinched in at the waist, just as a doughnut section would if moved near to the center. Then when the modulus equals the semi-diameter, the resulting conchoid will look much like a pair of ellipses, touching at the center. But really this pair will have a radius of curvature of zero at the center, like the cusp of a cycloid (which looks much like a semi-ellipse). And their evolute will be something like a pair of arrow points, with the points touching. All this, except the evolute, is shown in Fig. 1.

If we flatten the ellipse, the conchoids will likewise flatten. If we broaden it the conchoids will look more like circles, but by the time the ellipse becomes a circle, the paired curve will be reduced to a point.

Next let us make the modulus greater than half the short diameter. The conchoid immediately becomes a curve with four lobes. And when the modulus is three-fourths of the short diameter the lobes of this "rose" will be equal in length, but never in width. (Fig. 2).

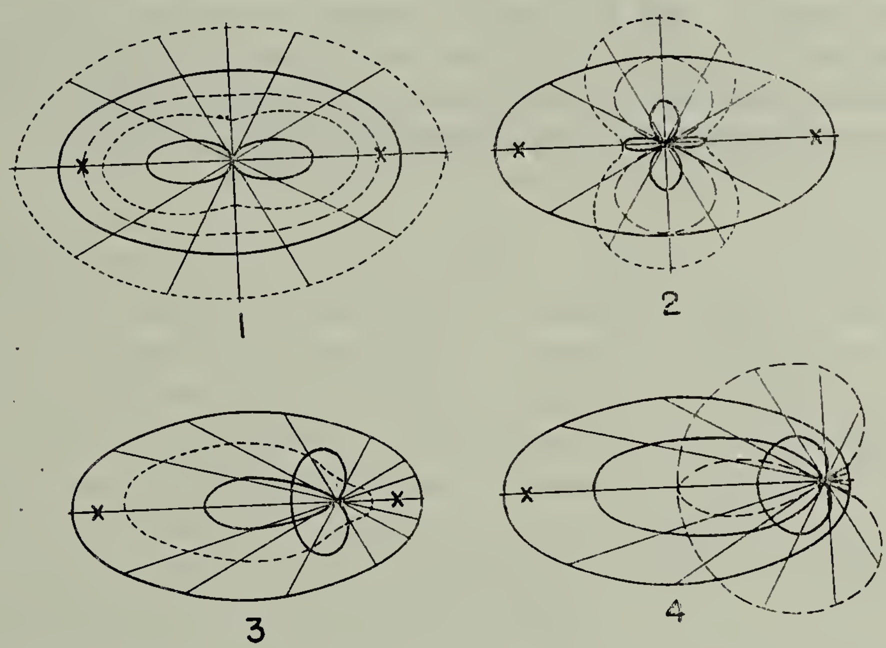
Now let us make the modulus equal to the short axis of the ellipse, or half the long axis. The resulting conchoid, shown in Fig. 2, will look much like a pair of circles, one above the other, and touching at the center. But here too the radius of curvature will be zero at the center. And a straight line connecting the apparent centers of the pair will approximate their evolute fairly closely.

Elongate the modulus still further, and we get a narrow-waisted or dumb-bell-like curve, suggesting one of those in Fig. 1, but turned at right angles to it, and partly outside the ellipse. Farther out the waist will broaden out, and the curve will approach a circle, something like the outer conchoid aforementioned.

Next let us move the pole from the center of the ellipse to the middle of one of the longer semi-diameters. Different lengths of modulus give an interesting variety of curves, two of which are shown in Fig. 3. One suggests an ellipse pinched in toward the end, and the other a limacon with three nodes, and the inner lobe protruding beyond the outer.

Finally let us put the pole at one of the foci of the ellipse, as

in Fig. 4. This gives us some more curves suggesting limacons. An enthusiastic student (if there be any such at this late date) could take up the problem here and develop other curves, which should be more exciting than the complicated equations that make up most of modern mathematical study.



Some conchoids of an ellipse. All based on an ellipse of the same size, twice as long as high. The crosses indicate the foci.

1. Pole of conchoid coinciding with center of ellipse. Shows an outer conchoid, scarcely distinguishable from an ellipse, a flat-sided curve that passes through the foci, a pinched-in curve suggesting a dumb-bell, and a two-lobed curve suggesting a pair of ellipses.

2. Pole of conchoid coinciding with center of ellipse. Shows a dumb-bell-like curve extending outside the ellipse, a two-lobed curve suggesting a pair of circles, and a four-leaved rose with lobes of unequal width.

3. Pole of conchoid in middle of longer semi-diameter of the ellipse. Shows an ellipse-like curve pinched in near one end, and a limacon-like curve with three nodes.

4. Pole of conchoid coinciding with one of the foci of the ellipse. Shows two looped conchoids suggesting limacons.

Let us now digress and consider briefly the evolutes of some of the conchoids. Take first the cusped phase of the original Nicomedean conchoid, based on a straight line. In its typical alignment it has only one parameter, the distance of the pole from the directrix, and is therefore always of the same shape, like the circle, parabola, cardioid, tractrix, and numerous others. It is scarcely distinguishable from the tractrix, though it has a very different equation.

The evolute of the tractrix, remarkable to relate, is said to be a catenary, a curve with very different properties. The evolute of a cusped conchoid must be similar, but it cannot be a catenary, for the tractrix already has that monopolized, so to speak. If not a parabola, it must be something very similar.

One might think a looped conchoid would have a pretty complicated evolute. But the evolute seems to pass through the node, and go off to infinite branches on either side, like that of the cusped conchoid, and it may be a parabola too. If so it is not the envelope of normals, as an evolute is supposed to be.

The Emerging Role of the Sociologist

Chester W. Hartwig
Auburn University

Possibly the greatest source of difficulty for your comprehension of the project I here undertake is the likelihood of your being relatively unfamiliar with the sociological discipline. In a prior session, I attempted something in the way of a preparation for you by addressing myself to the topic of the "intellectual power of the sociological perspective." That which I will be concerned with here is directly related to this type of understanding of the significance of the sociologist's orientation. Another difficulty of which I am fully appreciative, but with which I can do little at the moment, is the realization of how inadequate is my background, preparation, and capabilities when I pause to consider the magnitude and the inherent perplexities of the many issues which feed into my concern with the emergence of what I regard as a central social role in today's world setting.

Please do not misunderstand the nature of the venture on which I set forth. There is no intent on my part to attempt to bolster the prestige of a discipline and figure that often have been castigated and minimized. There is no intent to invidiously compare other scientific areas and functionaries or other-than-scientific approaches and figures to sociology and sociologists. As I pointed out in my previous preparatory effort on the intellectual utility of the sociological approach, it is relatively unimportant as to who makes use of the sociological perspective as long as it is used. I invite, nevertheless, your earnest attention to my earlier effort where it was asserted that the sociologist's point of view can be of distinct assistance in all scientific areas. In a period when science plays an evermore important part in all phases of human living, that, in itself, is no modest claim for sociology. I will not further disturb you at this point with any additional assertion as to the significance of sociology, but I assure you that a much vaster claim might be entered as to the significance of this discipline for man.

The vital and fundamental issue that I wish to confront in this paper is human purpose as it is related to the role of the

sociologist. My intent is to approach the topic positively, rather than with any intent or attempt to "lay waste" or even to depreciate those efforts, past and present, which surround this central feature of human living. I am fully cognizant of the fact that many in and out of science, including sociology, claim that my central problem is a non-scientific area of concern. I believe to the contrary. If you keep in mind the nature of my problem, epitomized in Tolstoi's question: "What shall we do? How shall we live?" and to which he thought science could return no answer, then you may tender me your sympathetic attention and indulgence for my effort in trying to deal with a difficult and never-ending problem for man. The only alleviation of this dismal prospect of puny capabilities confronting such a tremendous task, that I can think of at the moment, is the fact that I will modestly concern myself with the limited objective of attempting to state how I descry the sociologist's role as it may develop in relation to human purpose.

Let me call your attention to my perceiving this emerging role as a contingent proposition. Further, note that I will attempt no systematic survey of empirical materials attempting to document this role's emergence. All I essay in that which follows is to suggest a theoretical position which is concerned with some of the fundamental lineaments of the sociologist's function in the social life of our day. I hope the position taken does not ignore the empirical situation. With the time available, only a hasty sketch, a bare outline of this role can be set forth. If it should prove provocative, I will be content.

As seems rather apparent, the society and culture with which you and I are involved is a dynamic, forceful (one might say it is almost irresistable when viewed with respect to inter-cultural competition), and unique social order. As Arnold Toynbee stated many years ago—and little has occurred since that time to deny his claim:

> In the struggle for existence, the West has driven its contemporaries to the wall and has entangled them in the meshes of its economic and political ascendency, but it has not yet disarmed them of their distinctive cultures. Hard pressed though they are, they can still call their souls their own, and this means that the mental strife has not yet reached a decision.[1]

We will not stop to quibble over Toynbee's view as to the state of these other cultural "souls"; but as anthropologists and others have commented, if we wish to study peoples who have developed

distinct cultural existences apart, relatively, from the West, the job had best soon be done, for each day the opportunities for such research become less. Western cultural influences, with seeming inevitability, seep into the furtherest cultural reaches, the remotest corners of our world. The rapidly evolving collective existence of modern Western man intrudes and consumes, distorts and destroys other social traditions at a pace reminiscent of that established by the great subjugators of man's conquest epochs—a Genghis Khan, an Alexander the Great. The only serious cultural counter-challenge to be successfully mounted to these Western cultural depredations is patterned in great measure after the depredator's own cultural heritage and, hence, properly to be regarded as an intra-Western cultural force—obviously the reference is to the rise of international communism.

This rapid and overwhelming intrusion of Western cultural influences into all segments of the human community threatens to give rise to a unique human cultural condition not experienced by man collectively since that dim, far-off, irrecoverable time when what few men there were in this worldly setting persisted, possibly, in a few small groups possessing but a minimum, the bare rudiments of a quite similar cultural heritage. What is completely unparallelled in man's past, however, is our Western culture's breadth of cultural contact and awareness and accumulation, as well as what is probably in great measure a product of such extensiveness of acquaintances with human experience: the mind capabilities and potentialities of modern man. It is this presence of cultural richness and enhanced rationality in the human community which, in part, prods me to propose the expansion of the role and functioning of the sociologist.

In some respects, what I suggest as an addition to, or an emergent element of, the sociological role has been a persistent accompaniment to the develoment of today's role of the sociologist. Despite this continued presence, it has been and continues to be rather generally (and at times quite vociferously) rejected as an illegitimate activity for the sociologist as a sociologist. From the point of view of most of those who look on the sociologist first and foremost as a scientist—a position of which I am an advocate, the conception of science held precludes the sociologist, as a scientist, from the decision-making or value-judgment process.[2] The history of the development of sociology, with its innumerable examples of personal-social value intrusion into what purports, and seriously intends, to be strictly scientific work, amply justifies the

worries and vehemence of those who inveigh against those who at times stray toward or wander into the value-judgment area. In spite of my awareness of these pitfalls and the presence of the guardians of sociological purity, I feel compelled to urge the expansion of the scientific sociological role as to be inclusive of value-judgments. Indeed, I not only urge this expansion of the role but, additionally, suggest that it is a most likely emergent in the dynamics of this scientific discipline and perceptable if one understands the nature of science and the nature of the sociologist's task as it is related to human living and purpose.

Florian Znaniecki asserted long ago that human reality is value reality. Herbert Blumer not too long ago, in an article dealing with some problems of sociological analysis, set forth a statement about man's collective existence which, I believe, usefully represents the type of perspective that increasingly dominates our thinking about the human situation. He wrote:

> We can and, I think, must look upon human group life as chiefly a vast interpretative process in which people, singly and collectively, guide themselves by defining the objects, events and situations which they encounter. Regularized activity inside this process results from the application of stabilized definitions.[3]

W. I. Thomas, who is so well known for his phrase, "definition of the situation," which has proved so immensely useful in the study and understanding of human behavior, once wrote that the aim of scientific pursuits is: "the redefinition of all possible situations and the establishment eventually of the most general and universal norms, namely scientific laws."[4] Thus, we remember well the accounts of early scientists struggling to redefine the Western community's definition of its physical setting: the earth as round instead of flat, the sun as fixed relative to the movement of the earth instead of the opposite. In a much later period, we can appreciate the comment of Alfred North Whitehead about the disturbance—even for the scientist directly engaged in the redefinition process—attendant to modern redefinitions of our physical setting when he commented:

> . . . when I went up to Cambridge early in the 1880's . . . everything was supposed to be known about physics that could be known . . . physics was supposed to be a closed subject . . . By 1900 the Newtonian physics were demolished, done for! . . . it had a profound effect on me; I have been fooled once, and I'll be damned if I'll be fooled again![5]

If we now remember that sociology is a science which is specifically concerned with the analysis and conceptualization of man's social existence and the products which flow from his social living

including, in part, man himself; then we see that we must, if we would have science concern itself with social existence, accustom ourselves to this redefining activity of science in the area of man's social life. Additionally, we must accustom ourselves to our own personal existences being redefined in the process.

It was not without reason that upholders of the *status quo* in the realm of knowledge regarding the physical resisted the new intellectual orientations being created in advancing science, for it meant for them the necessity of having to try to live in a different physical setting with all of its inconveniences as well as whatever conveniences there might be associated with it. The conveniences of the developing knowledge, presumably have outweighed the inconveniences—for good or for ill. Possibly all we can assert is that these newer perspectives had sufficient convenience for the realization of human good as conceived by many in the generations of human beings along the way to the present, as well as among ourselves who live today, to the end that currently we find very few asserting the validity of the older perspectives that man once had as to the nature of his physical setting. Actually, of course, we hypothesize it to be pretty much the same old physical world of long ago, even though man's understanding of it and his relations with it have been greatly altered by the redefining of it.

Analogously, we live in a time when man's developing intellectual life and social science is systematically engaged in redefining man's collective existence and in redefining man himself. Rather obviously, many are more comfortable with the *status quo*, with traditional knowledge in this area. Again, possibly all we can assert is that if we perceive sufficient in the way of conveniences associated with the utilization of these newer perspectives as they may be related to a realization of what we may regard as the human good, then these newly created understandings of man will vitally, fundamentally reorient man to himself and to his society. Once more, we might hypothesize this creature, man, to be pretty much the same old human being of long ago, in a physical sense, but man's understanding of himself and of his relations with and to himself and with other human beings will be altered materially by the new social science knowledge. Such alterations have already occurred, of course; and many more lie close at hand. We may be reluctant to admit that as our social sciences have advanced, we have changed; but any sober and competent appraisal must admit man's different understanding of himself today from what he knew of himself only a short time ago. Pos-

sibly one of the most revolutionary reorientations of man to himself is contained in the prevalent view that "man makes himself." Earlier views often perceived man as a helpless pawn shoved about by some inscrutable fate. It may be that such we are, but the spirit of our time is that we are going to do something about it, whether we can or not; or that we conceive of this remaking of ourselves and our world as part and parcel of this inevitable destiny.

To return, then, to an earlier point, the sociologist as the social science figure with the most general and extensive interest in the specifically social has been, is, and will continue to be interested in man as a social being and in his social existence—to provide as best the sociologist can richer insights as to the nature of the social and its significance for man. Part of the concern of the sociologist, along with other disciplinarians, will be with the implications for man of having held to various interpretations of his universe and of himself. Whether the sociologist desires to do so or not, since new knowledge has its inevitable impact on man's evaluations and values held, the sociologist by virtue of his redefining activity is inextricably involved in the value-judgment process. If competent intellectual standards are part of this process of the accepting or rejecting of values or even in their conceptualization, as I believe is evermore true of man in our time, then the knowledge-expert of whatever area is firmly and crucially entangled with the making of human value-judgments.

NOTES

1. Arnold J. Toynbee, *A Study of History,* Vol. I (London, Oxford University Press, 1933), p. 35.

2. Not all, of course, emphasize sociology as a strictly scientific pursuit: see Robert Redfield, "The Art of Social Science," *American Journal of Sociology,* November, 1948, pp. 181-190. For a counter-view, see George A. Lundberg, "Science, Scientists, and Values," *Social Forces,* May, 1952, pp. 373-379.

3. Herbert Blumer, "Sociological Analysis and the 'Variable'," *American Sociological Review,* December, 1956, p. 686.

4. Quoted in: Edgar A. Schuler, *et. al.* (eds.), *Outside Readings in Sociology* (New York, Crowell, 1952), p. 184.

5. Lucien Price (recorder), *Dialogues of Alfred North Whitehead* (New York, Mentor, 1956), p. 277.

Alabama Academy of Science, Inc.

Membership List

January 1962

INDUSTRIAL MEMBERS

Vulcan Materials Company, Birmingham Slag Division, P. O. Box 7324-A, Birmingham 13, Alabama
Waters Theatre Company, 2839 Cahaba Road, Birmingham, Alabama

SUSTAINING MEMBERS

Alabama College
Auburn University
Birmingham-Southern College
Florence State College
Howard College
Huntingdon College
Livingston State College
Spring Hill College
University of Alabama
Exchange Security Bank (R. D. Russell), Five Pts. S., Birmingham
Southern Natural Gas Company, P. O. Box 2563, Birmingham
Dr. Hamilton Louis J. Marshall, 118 Florence Place, Mobile
Dr. J. D. Bush, P. O. Box 877, Gadsden
George R. Byrum, Jr., Pres., 1st Federal Savings and Loan Association, Birmingham

REGULAR MEMBERS

The following symbols are used to designate section perference:

I	BS	Biological Sciences
II	C	Chemistry
III	GA	Geology and Anthropology
IV	FGC	Forestry, Geography and Conservation
V	PM	Physics and Mathematics
VI	IE	Industry and Economics
VII	SE	Science Education
VIII	SS	Social Sciences
IX	MS	Medical Sciences

The following symbols are used to indicate classes of membership other than individual members:

*	Complimentary membership, Junior Academy sponsors
**	Collegiate
†	Honorary
(L)	Life
(F)	Fellow
(A)	Associate

Adams, Cleveland L., 845 Cary Dr., Auburn IE
Agee, Rucker, 706 First National Bank Bldg., Birmingham IE

*	Akers, James W., Emma Sansom High, 2200 Sansom, Gadsden	SE
	Aiken, W. C., 16 Edgewood, Selma	FGC
	Alexander, Dr. Thomas B., Box 3264, University, Ala.	SS
	Alford, Dr. William L., 4317 Horace Dr., N.W., Huntsville	PM
**	Allen, Miss Attrice G., Box 142, Bellamy	BS-C
	Allen, John Hollie, 244 Edgewood Dr., Florence	SS
	Allen, Roger W., Auburn University, Auburn	C
	Allen, Wendall E., Biology Dept., Ala. College, Montevallo	BS-MS
†	Allison, Fred J., Huntingdon College, Montgomery	PM
	Almond, Joseph C., Riverside Hospital, Newport News, Va.	MS
*	Aloyoius, Sister Mary, R.S.M., Mercy High School, 6 North Bay Mobile	SE
	Alvord, Ben F., Auburn University	SS
**	Anderson, Mrs. Katherine, 640 West Patton St., Montgomery	BS
	Andrews, Henry L., P. O. Box 797, University	SS
*	Andrews, Mrs. Mignon M., Auburn High School, Samford Ave., Auburn	SE
	Andrews, Warren M., Nuclear Science Center, Auburn University	PM
	Anson, Dr. Charles P., Auburn University	IE
	Arant, Frank S., Auburn University	BS
	Arnett, Miss Gussie, Southern Research Institute, 2000 Ninth Ave., S., Birmingham	BS
	Arnold, Paul J., Jacksonville State College, Jacksonville	SE
	Askew, Harold C., Medical Center, 1919 7th Ave. S., B'ham	MS
	Atkins, A. J., Auburn University	SE
**	Avery, Jack C., Route 3, Oneonta	BS
*	Bailey, Boyd L., Glencoe High School, Lonesome Bend Rd., Glencoe	SE
	Bailey, Hugh C., Howard College, Birmingham	SS
	Bailey, Joe W., Route 2, Heflin	GA
	Bailey, Paul C., Alabama College, Montevallo	BS
*	Baker, Joe D., Enterprise High School, Enterprise	SE
	Ball, Richard W., Auburn University	PM
	Bancroft, William H., Jr., 620 Hoadley Drive, Birmingham	PM
	Barker, Augustus L., 227 Marion Avenue, Auburn	C
	Barker, Samuel B., University Medical Center, Birmingham	MS
	Barr, E. Scott, Box 714, University	PM
*	Barranco, Nap, John Carroll High, 2317 Highland Ave., B'ham	SE
	Barrett, William J., Southern Research Institute, Birmingham	C
	Baswell, John L., 5613 10th Ave. South, Birmingham	IE
	Batson, John O., Box 66, Fulton, Alabama	FGC
	Baughman, Dr. Willis J., Box 2552, University	SE
	Bell, Miss Josephine R., 3612 Valencia Pl. N.E., Albuquerque, N.M.	BS
	Bennett, J. Claude, 724 McMillan Ave., Birmingham	MS
	Bennett, Kelley E., P. O. Box 761, Tuscaloosa, Alabama	GA
	Benton, Noel P., St. Dept. of Education, Montgomery	PM
**	Berdanis, Miss Nina, 102 Vonora Avenue, Montgomery	BS
*	Berryman, W. C., Sylacauga High, Sylacauga	SE
	Bertha, Sister M., F.S.B., Sacred Heart Academy, Cullman	PM
	Biebel, Paul, 4152 Yorkshire Lane, Mobile	BS

Bingham, Clarence P., 51 Cloverdale Road, Tuscaloosa GA
Bishop, Everett L., Jr., Box 1927, University BS
Black, Clifford D., Albertville High School, Albertville PM-SE
Black, William B., Gulf States Paper Corporation, Tuscaloosa FGC
* Blackburn, Ivt, Robertsdale High, Robertsdale SE
Blair, Arthur J., 1820 First National Bldg., Birmingham GA
Blair, Charles S., 2229½ 1st Ave. N., Birmingham GA
Blair, Dr. John Clyde, St. Dept. of Educ., Montgomery BS
Blair, Dr. Mary Grace, 1103½ W. 4th St., Little Rock, Ark. C
Bliss, Russell, Auburn University SS
Boehmer, Miss Kathryn M., 3928 Ave. K, Fairfield Sta., B'ham SE
Bonin, Joseph M., Dept. of Economics, Auburn University SS
Boozer, Reuben B., Jacksonville State College, Jacksonville BS
Boschung, Herbert T., Jr., Univ. of Alabama, P. O. Box 1927 BS
Boshell, Buris R., Vet. Admin. Hospital, 700 S. 19 St., B'ham MS
Boyles, James M., Box 1475, Mobile BS
** Bozeman, Tandy Key, 1205B 7th Ave., Tuscaloosa GA
Bradley, Miss Carolyn F., Dept. of Zoology-Entomology, Auburn University BS
Bradley, Charles F., Jr., Weather Bureau Airport Sta., B'ham FGC
Bradley, John M., Jr., Hwy. 280, P. O. Box 7527, B'ham 13 FGC
Brame, J. Y., 1568 College Court, Montgomery GA
Brannon, Mary Jane, 2080 Myrtlewood Dr., Montgomery GA
Brannon, Peter A., Dept. of Archives and History, Montgomery GA
* Brasher, Miss Catherine, Etowah High School, N. 4th St., Attalla SE
Braswell, Mamie, Country Club Apts., Apt. 3, 1631 E. Fairview, Montgomery PM
Bray, Gerald, O.S.B., St. Bernard C
Brezina, Dr. Edward S., 7610 Winterburry Pl., Bethesda 14, Md. MS
** Britton, Thomas Albert, Jr., Box 1239, University GA
** Brock, Oscar W., Jr., 712½ 12th St., Tuscaloosa GA
** Brockman, George Frederick, IV, Box 4932, University GA
Brown, Earl I., II, Chairman, Dept. Civil Engineering, Duke University, Durham, N.C. PM
Browning, James S., Box L, University GA
Brunson, Fox H., 2751 Ralston Road, Mobile C-BS
Bunger, William B., 603 Dumas Drive, Auburn C
* Burke, Mary Graves, Huntsville High, 2304 Billie Watkins Ave., Huntsville SE
Burton, L. P., Auburn University PM
Bush, Dr. J. D., P. O. Box 877, Gadsden MS
* Butler, Mrs. Barbara C., J. T. Wright School for Girls, 1315 Dolphin Street, Mobile SE
Butler, D. F., Troy State College, Troy SE
* Butler, Mrs. Maxine H., Fayette County High School, Bagwell St., Fayette SE
Cairns, Eldon J., Auburn University BS
Campbell, Mrs. James J., 1400 Forest Lane, Anniston C
Cantnell, Jerald Wayne, 1911 Crestline Ave., Sheffield BS
Cantrell, Dr. Clyde H., 175 Woodfield Dr., Auburn, P. O. Box 290 SS
Capps, Julius D., P. O. Box 309, Auburn C

†	Carmichael, Emmett B., University Medical Center, B'ham	MS
	Carmichael, John L., 3522 Salisbury Road, Birmingham	MS
	Carr, Howard E., Auburn University	PM
	Carroon, Lamar E., Box V, University, Alabama	GA
*	Carter, C. J., Anniston High, 1620 Leighton Ave., Anniston	SE
	Carter, Hugh P., 503 Title Guarantee Bldg., Birmingham	SS
	Casey, Albert E., 2236 Highland Avenue, Birmingham	MS
	Cason, Mrs. Louise R., Medical College of Ala., Birmingham	MS
	Chapman, Warner E., 1004 Audrey Dr., Holly Hill, Daytona Beach, Fla.	BS
	Chastain, E. D., Jr., Auburn University	SS
	Chermock, Ralph L., Box 1927, University	BS
	Chipman, Russell L., 3106 Pelzer Avenue, Montgomery	FGC
	Clark, Edward M., Dept. of Botany and Plant Pathology, Auburn University	BS
	Clark, Father Victor J., O.S.B., St. Bernard Abbey, Cullman	SE
	Clark, Otis M., Jr., 64 the Glen, Route 3, Tuscaloosa	GA
*	Clevenger, Earnest A., Russellville High, Russellville	SE
*	Cobb, James E., Bessemer High, 1414 2nd Ave., N., Bessemer	SE
*	Cobb, Mary B., White Plains, Rt. 6, Box 343, Oxford	SE
**	Cockrell, Wilburn Allen, Box 66, Mound State Monument, Moundville	GA
	Cole, Frank T., 562 Tuttle Avenue, Mobile	FGC
	Coleman, Mrs. Mary E., Auburn University Extension Service	SS
	Comer, Gordon, Jr., 233 Springhill Road, Alexander City	FGC
	Cook, John M., Box 693, University of Alabama	GA
	Cotter, David J., Alabama College, Montevallo, P. O. Box 97	BS
	Countryman, Mrs. Ruby, Troy State College	SE
	Covington, Perry C., 316 West Glenwood Drive, Birmingham	IE
*	Cowart, Mrs. Gladys W., Troy High, Elm St., Troy	SE
	Cowin, Percy G., 1 S.W. 18th Street, Birmingham	GA
	Crafts, Arthur G., Auburn University	PM
	Craig, Ed, Jr., 1240 50th Place So., Birmingham 12	GA
	Cramer, Dale L., Box 1973, University	SS-IE
	Croker, Thomas C., Jr., Box 311, Brewton	FGC
*	Crook, Mrs. Floyd, Opp High School, Opp	SE
	Curl, Elroy A., Auburn University	BS
*	Curley, Cleburn County High, Heflin	SE
	Dahlen, E. O., 1616 33rd St. West, Birmingham 8	GA
	Dale, William P., II, Howard College, Birmingham	SS
	Daniel, Adrian George, 1914 Holiday Drive, Florence	SS
*	Daniel, Miss Gay, Talladega High, 414 Oak, Talladega	SE
	Daniel, Thomas W., Geological Survey of Ala., P. O. Drawer O, University	GA
	Davis, Donald E., Auburn University	BS
	Davis, James Miller, 212 Guaranty Savings Bldg., Montgomery	GA
	Davis, Norman D., 616 Wright's Mill Rd., Auburn	BS-SE
	Dean, Mrs. Blanche, 2100—20th Ave., S., Birmingham 9	BS
	DeJarnette, David L., Box 66, Mound State Monument, Moundville	GA
**	Detrio, John A., P. O. Box 4500, S.W. 62nd Ave., Miami 55, Fla.	PM

Deuel, Dr. James T., 3818 Narrow Lane Rd., Montgomery 8 BS
DeVall, Wilbur B., 736 Cary Drive, Auburn FGC
Dickinson, Harry E., 1761 S. Lakeshore Dr., Birmingham 9 SS
Diener, Urban L., Auburn University BS
Dietz, Dr. Robert A., Troy State College, Troy BS
** DiMassio, Charles, University of Alabama GA
Dixon, Joe B., Dept. of Agronomy and Soils, Auburn Univ. GA
* Doby, Mrs. Lucie A., Citronelle High, Citronelle SE
Dodson, Chester Lee, Box 588, Hartselle GA
Doster, James F., P. O. Box 1955, University SS
Doubles, Dr. James A., Jr., B'ham-Southern College, B'ham BS
Douglas, Miss Sarah F., 212 Mecca Ave., Birmingham BS
Dowdy, Felix, International Paper Company, Mobile FGC
* Drennon, Robert L., Ramsay High, 1800 13th Ave., S., B'ham SE
Duffey, Lowell M., Department of Anatomy, U. of Ala. Med. Center, Birmingham BS-MS
Dulmadge, Miss Elizabeth Ann, 1612 S. 29th Terrace, B'ham 9 BS
Duncan, Archie B., 213 49th St., Fairfield BS
Duncan, Miss Bette, 2026 9th Ave. So., Birmingham 5 BS
(F) Dunning, Abram B., Box 599, Room G-309, Fairfield PM
Dusi, Julian L., P. O. Box 742, Auburn BS
Dusi, Mrs. J. L., P. O. Box 742, Auburn BS
Dyar, Grosvenor C., P. O. Box 354, Birmingham 2 GA
Dykes, Donald J., 1904 16th Ave., S., Birmingham BS-C
** Eich, Foster, III, Box 47, Fort Davis MS
Eisele, Louis J., S.J., Spring Hill College, Mobile PM
Elder, R. H., 1613 32nd Avenue North, Birmingham C
Elkayar, Dr. Abd Elmaquid, Professor, Faculty of Engineering, U. of Alexandria, Hadara, Alexandria, Egypt, U.A.R. PM
Elliott, Howard C., Jr., 124 Stratford Circle, B'ham 9 MS
** Ellis, John Thomas, Foundation des Etats-Unis, 19 Pd. Jourdon, Paris, France PM
* Ellison, Mrs. Dorothy S., Dora High School, Dora SE
Elton, Carey F., 728 Berea Avenue, Gadsden PM
Emerson, Dr. Geraldine M. (B), U. of Ala. Med. Cen., B'ham 3 MS
Emerson, Jack D., University Medical Center, Birmingham MS
Engelbrecht, Mildred A., Dept. of Bacteriology, University BS
Estes, Dr. Edna E., State Teachers College, Salisbury, Md. BS
Evans, Dr. Lawrence E., Small Animal Surgery and Medicine Dept., Ontario Vet. College, Guelph, Canada MS
** Evans, Sam Teddy, Jr., Box 5052, University BS
Everton, Edgar R., Walker College, Jasper GA
Evers, Ray, Andalusia MS
* Fairhope High School, Fairhope SE
Farish, Preston, 937 Lakeview Drive, Auburn BS
† Farmer, C. M., Troy State College, Troy BS
** Farmer, Joe A., P. O. Box 2782, University BS
Farnell, Dr. Daniel R., 1157 Rudd Ave., Auburn MS
Feazel, C. E., Jr., Southern Research Institute, Birmingham C

	Fies, Dr. Milton H., 1201 Comer Bldg., Birmingham	IE
	Fikes, Alan G., 1205 Heflin Ave., Birmingham 14	C
	Fincher, J. A., Howard College, Birmingham	BS
	Finley, Dr. Wayne H., University Medical Center, B'ham	C
	Finn, Sidney B., University Medical Center, Birmingham	MS
	FitzGerald, Richard W., 1805 Holly Street, Montgomery	BS
	Fleming, Julius D., 328 Palisade Drive, Florence	C
	Floyd, H. H., Florence State College, Florence	C
	Foley, Mrs. James O., 409 Sunset Drive, Birmingham	MS
**	Forester, Jerrold, Route 2, Box 76, Jasper	GA
*	Fox, David, Organic School, Fairhope Ave., Fairhope	SE
	Fox, Glenn J., 573 Clearview Dr., Birmingham 16	BS
	Francis, Robert D., University Medical Center, B'ham	MS-BS
	Friedman, Dr. Louis L., 2528 Beverly Drive, Birmingham	MS
	Frisby, Carl E., Auburn University	IE
*	Fryer, John L., Pike County High, South Main, Brundidge	SE
	Furman, Father W. L., Spring Hill College, Mobile	PM
	Gallaway, Robert E., 6030 S. 5th Court, Birmingham	MS
	Gamble, Halbert R., 3805 Day St., Lot E-22, Montgomery 8	GA
	Gandrud, B. W., 311 Caplewood Terrace, Tuscaloosa	IE
†	Gardner, Dr. Wright A., P. O. Box 751	—
	Garin, George I., Forestry Dept., Auburn University	FGC
	Garner, Robert H., School of Chemistry, U. of Ala.	C
**	Garrett, Arthur Randolph, Jr., 5 Bloch St., Montevallo	BS
	Garrett, Mrs. Marion H., 4212 Overlook Dr., Birmingham	MS
	Garrett, W. Walton, 4212 Overlook Dr., Birmingham	IE
	Gary, C. M., 800 N. Pelham Road, Jacksonville	C
	Gayle, John B., M-S&M-MO, National Aeronautics & Space Adm., George C. Marshall Space Flight Center, Huntsville	C
*	Geisler, Miss Edith, Hueytown High School, Hueytown	SE
	Gerhardt, Henry, P. O. Box 665, Waynesville, N.C.	MS
	Gibbs, Billy, 102 N.W. 10th Street, Arab	PM
*	Gilliland, Mrs. Prudence, Hokes Bluff High, Rt. 2, Gadsden	SE
	Gilmore, Mrs. Vivian, Choctaw County High, Butler	SE
	Glarum, Dr. Sivert N., Southern Research Inst., B'ham	C
	Glasgow, Dr. Richard D., 3009 Brookwood Road, B'ham 13	MS
*	Gober, Mrs. Gordon, Red Bay High, Red Bay	SE-C-BS
(L)	Goethe, Dr. Charles M., 3731 Tea St., Sacramento 16, Calif.	BS
	Goetz, James R., 2021 6th Avenue N., Birmingham	IE
	Gordon, Dr. Kenneth M., B'ham-Southern College, B'ham	C
	Gore, Clayton E., Jr., 1828 Oxmoor Rd., Birmingham	GA
	Gorrie, Miss Rachel H., 2155 Montezuma Road, Montgomery	BS
	Gran, Dr. John E., 6 Hillcrest, Tuscaloosa	C
**	Gray, Sidney F., 314 Elyton Parkway, Birmingham	GA
**	Gray, T. Randolph, 4700 Avenue T, Central Park, B'ham	GA
**	Green, Miss Jewel C., Box 5958, University	GA
	Green, Margaret, University of Alabama	MS
	Grove, Dr. E. L., Armour Research Foundation, 10 W. 35th Chicago, 16	C
	Guest, William C., Dept. of Biology, University	BS

** Guthrie, Mrs. Catherine S., Calif. Inst. of Technology, Division of Biology, Pasadena, Calif. BS
* Hafling, Miss Mary E., West End High, 1840 Pearson Ave., B'ham SE
Hall, Clarence C., Jr., Howard College, Birmingham BS
Hamel, Dr. Earl G., Jr., Dept. of Anatomy, University of Ala. Med. Center, Birmingham MS-BS
Hamlett, Miss Mary Kline, 25 Edgehill Rd., B'ham MS
Hammack, J. J., Livingston State College, Livingston C
Hampe, David E., 2720 Mt. Royal Circle, Birmingham FGC
Hansen, A. T., Box 2982, University GA-SS
Hanson, Roger W., University Medical Center, Birmingham MS
Hare, Ruth S., 8944 Fourth Ave. South, Birmingham MS
Hargis, Dr. Estes H., 1131 N. 28th Street, B'ham MS
Hargreaves, George W., 239 Woodfield Dr., Auburn C
† Harper, Roland M., Box O, University GA
Harris, Augustus J., Drawer O, University GA
* Harris, Miss Ethel, Montevallo High, Montevallo SE
Harris, Wiley F., Jr., Lot 509, Paradise Trailer Park, 2513 Bob Wallace Ave., S.W., Huntsville GA
Harrison, David George, 1924 9th Ave., South, B'ham BS
Harrison, Sister M. Eleanor, Sacred Heart Academy, Cullman PM
Hartley, Dr. Marshall W., 2221 Mtn. Lake Ter., B'ham 16 MS
Hartwig, Chester W., 633 Sanders St., Auburn SS
Harvey, Dr. Henry T., 2249 Houston St., Florence BS
Haskell, Preston H., Jr., 205 South 32nd St., B'ham GA-FGC-IE
Hastings, Earl L., Box 166, Eufaula GA
Hawley, William L., 312 Med. Arts Bldg., Birmingham MS
Hayles, Miss Kitty Sue, 340A Perry St., Chickasaw SE
Heide, S. S., 2204 28th Street West, Birmingham C
Hemphill, A. F., Spring Hill College, Mobile BS
(L) Hendon, John F., 1631 3rd Avenue North, B'ham IE
Herren, Glen W., 2105 Warrior Road, P. O. Box 3873, B'ham 8 SS-MS
Heustess, William Arthur, 1313 Adrian Lane, Montgomery BS
Heyn, Dr. Anton N. J., Dept. of Physics, Auburn Univ. PM-BS-C
Hicks, Patrick M., LaGrange College, LaGrange, Ga. C
Hicks, Thomas I., Route 4, Box 720, Birmingham PM
Hieserman, Clarence E., Chemstrand Corp., Decatur C
Hill, Johnie B., Jr., 7810 7th Ave. S., Birmingham BS
Hill, Dr. S. Richardson, Jr., Univ. Med. Center, B'ham MS
Hinton, John H., Jr., A-24 Admin. Bldg., Wilson Dam, Ala. FGC
Hirschowitz, Basil I., Dept. of Med., Univ. Med. Center, B'ham MS
Hisey, Alan, Box 1412, University MS
Hitchcock, J. G., Land Dept., Ala. Power Co., B'ham IE
Hites, Robert W., B'ham-Southern College, B'ham SS
Hitt, Miss Nellie W., Box 255, Troy SE
Hocking, George M., Auburn University MS
* Hodge, Mrs. Ruby, McAdory High School, McCalla SE
Hodgkins, Dr. Earl J., 555 Wright's Mill Road, Auburn FGC
Hoffman, Henry H., Univ. Med. Center, Birmingham MS
Hogelin, Milford C., 819 Canterbury Dr., Rt. 8, Bessemer FGC
Holley, Howard L., Univ. Med. Center, Birmingham MS

* Holcombe, Joseph B., Munford High School, Munford	SE
** Holliman, Dan C., Box 1927, University	BS
Hooks, W. Gary, Box 1945, University	GA
Howell, G. L., P. O. Box 643, Memphis State University, Memphis 11, Tenn.	BS
Howes, Dr. James Raymond, P. O. Box 574, Auburn	BS-MS
Howse, B. C., Box 537, TCI Division, Fairfield	BS
Huff, C. F., Jr., Florence State College, Florence	C
* Huffman, Mrs. Elizabeth, Shades Valley High School, Homewood Station, Birmingham	SE
Huffman, Ernest O., 909 North Pine St., Florence	C
** Hughes, Lynn N., Box 2302, University	GA
* Humber, Albert, Jackson High School, Jackson	SE
** Hunt, Miss Joan H., Route 2, Box 424A, Montgomery	BS
Hunt, Thomas E., University Medical Center, Birmingham	MS
Hurtt, Oscar Lee, Jr., P. O. Drawer 2562, Birmingham	C
Huttlinger, Frank D., Box 1945, University, Alabama	FGC
Irons, George V., 8143 Division Avenue, Birmingham	SS
Irvine, Paul, Auburn University	SS
Ivey, William D., Auburn University	BS
* Jackson, Aubrey, Tanner High School, Tanner	SE
† Jennings, Henry L., P. O. Box 263, Clermont, Fla.	IE
** Johnson, Eugene F., Route 2, Jacksonville	BS
Johnson, Robert B., 1518 S. 13th St., Birmingham	C
Johnson, Searcy H., Jr., 432 Longview Dr., Birmingnham	IE
Johnson, Walter H., 1919 7th Ave. S., Birmingham	MS
Joiner, Thomas J., Geological Survey of Ala., Box O, University	GA
Jones, Douglas E., Box 1945, University	GA
† Jones, Dr. E. V., 213 East Vanderbilt Dr., Oak Ridge, Tenn.	C
Jones, Mrs. Frances, 926 S. Lawrence St., Montgomery	SE
Jones, Mrs. Jack, Livingston State College, Livingston	BS
** Jones, James Raphael, 1804 Delta St., Mobile, Ala.	PM
Jones, John W., 942 5th Place West, Birmingnham 4	GA
† Jones, Walter B., University	GA
* Jongeblood, Mary E., Bishop Toolen High for Girls, Lafayette & Old Mill Rd., Mobile	SE
† Kassner, J. L., 1620 2nd Avenue, Tuscaloosa	C
Kaylor, Hoyt M., B'ham-Southern College, B'ham	PM
Kearley, Francis J., Jr., Spring Hill College, Spring Hill	C
Keeler, James E., 3576 N. Georgetown Dr., Montgomery	BS
Kelley, Roscoe D., Troy State College, Troy	SE
Kemp, Dr. Robert T., 816 Linwood Ct., S., Birmingham 5	C-SE
Kennamer, Earl F., Route 2, Box 384, Auburn	FGC
Kincaid, James H., Thorsby High School, Thorsby	BS
Kinson, Gordon Alastair, Univ. Med. Center, B'ham	MS-C
Klapper, Clarence E., Univ. Med. Center, B'ham	MS
Klapper, Mrs. Margaret S., Univ. Med. Center, B'ham	MS
Klip, Dr. W., Univ. Med. Center, B'ham	MS-PM
Klontz, Dr. Harold E., Auburn University	SS
** Knight, Marvin S., Box 4318, University	GA
Knight, Vernon J., Coosa River Newsprint Co., Coosa Pines	FGC

Kochakian, Dr. Charles D., Univ. Med. Center, B'ham MS
Krizek, 1st Lt. Donald T., Dept. of Botany, Univ. of Chicago, Chicago 37, Illinois BS-FGC-SE
Kuderna, Jerome G., 157 Cary Drive, Auburn SE
** Kurjack, Edward B., Box 6126, University GA
Laffre, Dr. Randall O., Jr., 200 S. Monterey St., Mobile 19 SE
LaMoreaux, Phillip E., University, Box 2033 GA
Land, Dr. James E., Auburn University C
Langley, Leroy L., Univ. Med. Center, B'ham MS
Lanham, Ben T., Auburn University SS
Larquier, Everett, S.J., Spring Hill College, Spring Hill PM
Larsen, Aubrey B., Box 952, Auburn BS
Laseter, William Ray, 713 77th Way S., Birmingham 6 C
Laster, William R., Jr., 3833 Cromwell Dr., B'ham 13 MS
Lawrence, Dr. Norman L., University Med. Center, B'ham MS
Lawson, J. Keith, Jr., 1310 Morningside Ct., Decatur C
* Ledbetter, T. R. Miller High School, Belleville Ave., Brewton SE
Leibold, Armin A., Route 1, Box 448, Auburn BS
Lenfesty, Franklin A., 148 Garfield Ave., Florence C
* Leonard, Miss Lillian, Box 329, Bay Minette, (Baldwin Co. High) SE
Lewis, Arthur J., Crescent Hill, Selma SE
Lewis, Dr. F. A., Box 1444, University PM
Lindall, Dr. Dale R., 617 Riverview Ave., W., Apt. 401, Dayton 6, Ohio MS
** Lindsey, Miss Georgia I., Route 1, Elmore BS
Lindsey, Ralph H., 325 West Mountain, Jacksonville PM
Lipe, George W., College Apts., Route 1, Montevallo BS
Livingston, Knox W., Auburn University FGC
Lloyd, Mrs. Lucille N., 16 N. Bayview Avenue, Fairhope C-SE
Long, A. R., 1106 East Audubon Road, Montgomery C
* Long, Mrs. Pauline K., 5323 10th Ave. S., B'ham (Woodlawn High) BS
Longley, Robert W., Univ. Med. Center, B'ham 3 MS
Leuth, Francis X., Box 415, Centerville BS
Lyle, Everett, Samuel, Jr., Auburn University FGC
Lyle, James A., Auburn University BS
* Lyons, Mrs. Francis T., Tuscaloosa High, 905 15th St., Tuscaloosa SE
MacElvain, Robert C., Box O, University GA
McCaffrey, J. E., International Paper Co., Mobile FGC
McCann, Franklin T., Box 325, Auburn FGC-GA
McCullough, Herbert A., Howard College, Birmingham BS
McCullough, John M., 2844 Spann Place, Montgomery FGC
† McGlamery, Miss Winnie, Box O, University GA
** McKenna, Michael P., 1124 Montclair Road, Birmingham GA
McKibbin, Dr. John Mead, 3 Montcrest Dr., B'ham 13 BS-C
McKnight, Everett A., Woodward Iron Co., Woodward FGC
McReynolds, Joseph L., Jr., 1461 Hamilton Road, Mobile GA
McTyeire, Miss Evelyn (Clustie), 1804 Arlington Ave., Bessemer SE
McVay, Thomas N., 19 Oadwood Court, Tuscaloosa C
* McWhorter, Cedar Bluff High, Cedar Bluff SE
Mainland, Gordon B., Ayres Hall, Jacksonville State College
Mainland, Mrs. Rosemary C., 1116 9th Ave. N., Jacksonville BS

	Manley, Mrs. Lillian C., Livingston State Col. Livingston	C-BS-SE
**	Maples, William Don, Box 1885, University	GA
*	Marsh, Lamar, Geneva Co. High School, Hartford	SE
	Marshall, Hamilton, 118 Florence Place, Mobile	MS
	Martin, John Vincent, P. O. Box 456, Butler	FGC
	Martindale, William E., 424 Orchid Road, B'ham 15	C
	Mayer, William C., Jr., 1467 Alford Avenue, B'ham	C
	Mayfield, Shelby V., 3100 Cliff Road, Birmingham 5	BS-SS
	Maynor, Dr. Hal W., Jr., 518 Cary Drive, Auburn	PM
	Melius, Dr. Paul, Auburn University	C
	Merkal, Richard S., Route 2, Box 20, Auburn	C
	Meyer, Freida L., 1410 Cloverdale Apts., Tuscaloosa	BS
	Miles, R. Vance, Jr., 1014 Myrtlewood Dr., Tuscaloosa	FGC
	Miles, Richard V., III, Suite 1006, 1st Natl. Bank Bldg., Tuscaloosa	FGC
	Minton, Norman A., Auburn University	BS
	Mixon, Aubrey C., 718 Cary Drive, Auburn	BS
	Mobley, Willard M., Box 6527, Tarrant	IE
**	Moore, Donald B., 620½A, 11th St., Tuscaloosa	GA
	Moore, O. C., Auburn University	C
	Morehead, Beachley A., Chemstrand Corp., Decatur	C
	Morgan, Roy B., 101 Brookside Drive, Greenville	FGC
**	Morrell, L. Ross, Mound State Monument, Box 66, Moundville	GA
	Morris, Ella D., P. O. Box 811, Mobile	BS
	Morris, Frederick K., 3334 Southmont Dr., Montgomery	GA
	Morris, Jack, 1101 N. Jackson Avenue, Russellville	GA
	Mosley, Samuel A., Chemstrand Ltd., Caleraine No. Ireland, U.K.	C
	Mount, Dr. Robert H., Dept. of Biology, Ala. College, Montevallo	BS
	Murdaugh, Dr. Hershel Victor, Jr., Glenview Cir., B'ham	MS
	Murray, Royce L., Ala. Power Co., P. O. Box 5266, B'ham	MS
	Nakane, Paul K., Biology Dept., Brown Univ., Providence, R.I.	BS
	Nancarrow, Virginia, 617 St. Charles Ave., SW, B'ham	BS
*	Noles, B. V., Fort Payne High School, Ft. Payne	SE
	Nesbitt, Paul H., Chief, ADTIC, Research Studies Institute, Maxwell AFB	GA
	Newton, John G., 2200 Forest Lake Drive, Tuscaloosa	GA
	Nichols, Samuel H., Jr., 130 Cary Drive, Auburn	C
	Norton, Capt. Eugene E., ROTC Dept., Spring Hill College, Mobile	SS
*	Nuss, John L., Cullman High School, Cullman	SE
	O'Kelley, Joseph C., Box 1927, University	BS
	Ottis, Kenneth, Auburn University	BS
	Overton, Eleazer C., 2195 Warrior Road, 5 Points West, Birmingham	MS
	Padgett, Mrs. Carol Ann, Biology Dept., Huntingdon College	BS
	Palmer, George D., Jr., University of Alabama	C
	Palmore, Robert D., 3029-B Cloverdale Rd., Montgomery	GA
	Parfitt, Dr. Gilbert J., 2117 Pioneer Drive, Birmingham	MS
	Parker, W. V., Auburn University	PM
	Parrish, James N., Shell Oil Company, Box 1509, Midland, Tex	GA
	Patton, Ernest Gibbes, Box 1927, University	BS
	Patton, Mrs. Francis M., University Medical Center, Birmingham	C
	Paul, Miss Edna, Bay Minette	SE
	Paustian, E. C., Route 4, Box 370, Decatur	SS

* Phinney, Mrs. Ida Bell, Slocomb High School, Slocomb SE
Pigman, Ward, New York Medical College, Fifth Ave. at 106th St., N.Y. 29, N.Y. MS
Pittman, Constance S., 1006 19th Street South, Birmingham MS
Pittman, Dr. James A., Jr., 1006 19th Street South, Birmingham BS-MS
* Poland, Harold, Childersburg High School, Childersburg SE
Poole, William L., 722 Woodward Building, Birmingham MS
Porter, Earl, 123 Florence Place, Mobile FGC
** Powell, Miss Patricia Ann, Prattville BS
Powell, William J., 12 Brookhaven, Tuscaloosa GA
Prather, Mrs. Mary E., School of Home Ec., Smith Hall, Auburn U. BS
Price, Edwin O., 251 Cary Drive, Auburn C
Price, Emmett W., 1921 Lookout St., Mitchell Park, Gadsden MS
* Price, J. L., Robert E. Lee High School Ann St., Montgomery SE
Price, Leroy, Smith Avenue, Elba PM
Quigley, Dr. Mervin B., 2927 S. 19th Street, Birmingham MS
Quinnelly, Mrs. Barbara G., 736 Jackson Circle, Birmingham BS
Quintarelli, Dr. Giuliano, University Medical Center, Birmingham MS
* Rae, Miss Mary C., Carbon Hill High School, Carbon Hill SE
Ramsey, Dr. John F., P. O. Box 1513, University SS
** Rau, William H., Route 4, Hanceville MS
Reece, Orvil Y., East 15th Street, Tuscaloosa GA
Reeder, Charles, 1905 Windsor Avenue, Montgomery PM
* Reid, Mrs. Harry, Parrish High School, Selma SE
Reiner, Charles, O.S.B., St. Bernard College, St. Bernard C
Reynolds, William B., 1514 South 15th St., B'Ham (Woodlawn High) C
Rhein, Walter J., Spring Hill College, Spring Hill PM
Richards, Dr. D. B., Auburn University FGC
Richards, Dr. E. F., Head of Dept. of Geology and Geography, University of Alabama GA
Richardson, Dr. Jesse M., P. O. Box 567, Auburn FGC
Richardson, Ronald John, c/o Chemstrand Corp., Courtland Hwy., Decatur C
Riggsby, Ernest D., Box 525, Troy State College, Troy SE
Roberts, Bruno R., P. O. Box 731, Durham, N. C. C
* Roberts, E. R., Foley High School, Foley SE
Roberts, Leo Bogan, State Dept. of Agriculture, Montgomery C
* Robinson, G. T. Russellville High School, Russellville SE
Rodgers, Dr. Eric, Box 1472, University PM
Rupert, Rodney H., Siluria Clinic, Siluria MS
Salmon, W. D., Auburn University MS
Sanford, Thomas H., Jr., 2626 Bonita Circle, S. W., Huntsville GA
* Satsuma High School, Satsuma SE
Saunders, Charles R., 369 Payne Street, Auburn C
Schneyer, Leon D., University Medical Center, Birmingham MS
Schnitzlein, Dr. Harold N., University Medical Center, Birmingham MS
Schwartz, Dr. Ferdinand F., 916 South 20th St., Birmingham MS
Scott, Robert B., Jr., 14 Guilds Wood, Tuscaloosa C
Searcy, Margaret Z., 50 Cherokee Rd., Tuscaloosa SS

	Seibold, Herman R., Box 454, Greenport, Long Island, New York	MS
	Sensenig, E. Carl, University Medical Center, Birmingham	MS
	Sevier, Sister Mary Susan, Sacred Heart Academy, Cullman	PM
	Shackleford, John M., University Medical Center, Birmingham	MS
**	Sheldon, Craig Turner, Jr., Box 3964, University	GA
	Sheldon, Dr. Richard P., U. S. Geological Survey, Federal Center, Denver, Colorado	GA
*	Shelnutt, Mrs. T. J., Hadley High, West Point Street, Roanoke	SE
	Shields, Alan J., Auburn University	SS
	Shoffeitt, Paul E., 759 East Samford Avenue, Auburn	MS
	Shotts, Reynold Q., 8 Forest Lake, Tuscaloosa	GA
*	Simmons, Alvin J., University Military School, 65 N. Mobile St. Mobile	SE
	Simpson, Thomas Alexander, P. O. Box 0, University	GA
	Sizemore, W. R., Box 157, Tallassee	FGC
	Skinner, Robert Wade, Rt. 4, Box 171-A, Montgomery	BS
**	Smith, B. B., Jr., 810 15th Avenue, Tuscaloosa	C
*	Smith, Miss Claudia, Minor High School, Birmingham	SE
	Smith, Donald F., Box., University	C-IE
	Smith, E. V., Comer Hall, Auburn University	BS
	Smith, Frank J., Route 1, Box 187-A, Loxley	FGC
	Smith, Mrs. H. Morgan (Marjorie B.), 409 S. Copeland Tallahassee, Fla	MS
	Smith, Robert Charles, 1235 Cresthill Road, Birmingham 13	BS
	Smith, Septima C., Box 1386, University	BS
	Smith, William Everett, P. O. Box 506, Glencoe, Ala	GA
	Snyder, Robert Loring, 3266 Wilmington Road, Montgomery	FGC
	Spann, Ransom, 370 East Thach, Auburn	PM
**	Spence, Allyn G., 514-13th St., Tuscaloosa	GA
	Spencer, G. O., Troy State College, Troy	PM
	Spencer, Miss Lilly H., Auburn University	SS
	Spidle, Mrs. Marion W., 306 Cary Drive, Auburn	SS
	Spieth, Alda May, Livingston State College, Livingston	BS
	Stauffer, Jacob M., North 32 Arlington Road, Montgomery	FGC
	Steele, H. Ellsworth, 830 Salmon St., Auburn	SS
*	Steeley, Mrs. Esther McCartney, Samson High School, Samson, Ala.	SE
	Stelzenmuller, J. G., 412 S. W. 12th Street, Birmingham	IE
	Stephens, Mrs. Lois Carter, Route 1, Troy	BS
	Stephens, Miles, Box 893, Auburn	FGC
	Stephenson, Charles V., 1805 Mission Road, Birmingham	PM
	Sterks, Dr. H. E., History Dept., Troy State College, Troy	SS
	Sterne, Dr. M. H., RFD 2, Box 616, Birmingham	IE
	Stevens, Frank J., Auburn University	C
	Stickney, Mrs. Hazel L., Livingston State College, Livingston	FGC
	Stone, Paul T., Huntingdon College, Montgomery	C
	Strickland, Harold S., 756 Walnut St., Gadsden	SE
	Sudhoff, Roy W., 1807 Stratford Rd., S.E., Decatur	C
	Sullivan, John L., Box 276, Birmingham	IE
(L)	Sulzby, James F., 3121 Carlisle Road, Birmingham	IE

Summerlin, Lee Roy II, 2420 S. W. 27th Terrace, Miami, Florida BS
Summersell, Charles G., Box 1936, University SS
Swindel, George W., Jr., P. O. Box O, University, Alabama GA
(A) Tankersley, Richard, Route 3, Alexander City BS
Tanner, Ralph M., Route 1, Dora SS
Tate, John M., Box 344, Arab C
* Tatum, R. C., Murphy High School, Mobile SE
Taylor, M. Kenneth, Sharp's Apt., Block St., Montevallo BS
* Taylor, Mrs. Martha, Haleyville High School, 21st St., Haleyville SE
* Teague, John H., Decatur High School, Decatur SE
Teague, Robert S., University Medical Center, Birmingham MS
* Terry, E. A., Vigor High School, 601 N. Wilson Ave., Prichard SE
* Thom, T. G., Boaz High, Brown St., Boaz SE
Thomas, Dr. Alfred B., Box 1491, University SS
Thomas, Dr. Joab L., Dept. of Biology, P. O. Box 1927, University BS
Thompson, Davis Hunt, 917 Valley Road Place, Birmingham C
Thompson, Mrs. Georgia J., Station 3, Bryce Hospital, Tuscaloosa MS
Thompson, H. LeRoy, 329 Brown-Marx Bldg., Birmingham C-IE
Thompson, Mrs. Margene G., 353 Park Ave., Shades Mt., Birmingham SE
Thompson, Woodford R., Jr., 503 Title Bldg., Birmingham C
Thompson, Mrs. Wynelle D., 917 Valley Road Place, Birmingham C
Thomson, J. Richard, Southern Research Institute, 2000 9th Ave. S. B'Ham MS-BS
Todhunter, Dr. E. Neige, Box 1051, University C
Toffel, George M., 303 Queen City Avenue, Tuscaloosa C
Townes, M. Halsey, 2712 Mt. Royal Circle, Birmingham IE
* Traywick, R. L., Marion Military Institute, Marion SE
* Tredaway, Mrs. Martha, Jacksonville High, Jacksonville SE
Trickey, Dr. E. Bruce, 215 Third Street, Chickasaw C-GA
Tucker, Edd Kyle, Box 97, Camp Hill C
Turner, Henry F., Auburn University BS
Twellmeyer, George O., Spring Hill College, Mobile C
Ucci, Pompelio A., Chemstrand Corporation, Decatur C
Van De Mark, Mrs. Mildred, Auburn University, Auburn BS
Varnedoe, Wm., Jr., Route 4, Box 1811, Huntsville GA
Veasey, Dr. Thomas M., 2026 Woodland Street, Decatur C
* Veigl, Father Ronald, O.S.B., St. Bernard Prep Seminary, St. Bernard SE
Vess, David M., 1140 No. Shadesview Terrace, Birmingham 9 SS
Viccars, Miss Marion, 2133 Mt. Meigs Road, Montgomery BS
Vickery, Katherine, Alabama College, Montevallo SS
Volker, Joseph F., University Medical Center, Birmingham MS
Wade, Albert M., Jr., 2514 10th Ave. S., Apt. No. 1, B'Ham 5 BS-MS
** Waits, E. Douglas, 406 9th Court, Bessemer BS
Walker, Katherine, Route 5, Mars Hill Road, Florence BS
Walker, Alfred A., III, 4137 Crescent Road, Birmingham MS
Walker, Dr. J. Henry, University Box 1927 BS
* Wallace, Woodson D., Alexandria High School, Alexandria SE
Ward, Henry S., Jr., Pinecrest Farms, Route 2, Prattville BS
* Ward, Mrs. Mary E., Box 196, Wilmer (Semmes High School) BS

Warman, James C., P. O. Box V, University, Alabama
Watson, J. Hilton, Box 1108, Montgomery FGC
(L) Weber, Dr. Bernard C., Box 5315, University SS
Weidner, Dr. John P., 1600 Texas Drive, Pensacola, Fla. C
* Welford, Mrs. Lizzie M., Mobile County High, Grand Bay SE
Westover, Fredrick L., Box 1553, University SS
Wheelahan, Edmund J., ABMA Systems Design & Development Laboratory, ORDAB-RSMF, Redstone Arsenal, Ala. C
Wheeler, Dr. R. E., Howard College, Birmingham PM
White, Horace Gene, 23 Southmont Dr., Tuscaloosa GA
* White, J. Dossie, Hale County High, Moundville SE
White, Dossey H., Box 1009, University GA
White, Locke, Jr., Southern Research Institute, Birmingham C
Whiteford, Dr. Robert D., School of Veterinary Medicine, Auburn University MS-BS-SE
Whitehead, Dr. Fred, 3496 Cloverdale Road, Montgomery C
Whitfield, James W., Box 134, Eutaw GA
Whitt, Carlton D., Chemstrand Corporation, Decatur C
* Whittaker, Fred, Hewitt-Trussville High School, Trussville SE
Widdowson, Dr. David C., 1121 North Three Notch Street, Troy BS
Wiese, Peter V., P. O. Box 2251, Montgomery GA
Wilcox, Harold E., Birmingham-Southern College, Birmingham C
Wilkes, Dr. James C., Dept. of Biology, Miss. State College for Women, Columbus, Mississippi BS
Wilks, Dr. William T., Troy State College, Troy SE-PM
* Williams, W. L., Oxford High School, Oxford SE
** Williford, Ernest John, 725 Clayton Street, Montgomery C-BS
Wilson, Dr. Hazel Schoonmaker, Jacksonville University, Jacksonville 11, Florida PM
Wilson, Dr. L. T., Jacksonville University, Jacksonville 11, Fla. PM
Wimberly, Steve B., Route 13, Box 826, Birmingham 13 GA
Wingard, R. E., Box 177, Auburn C
Wingo, William J., University Medical Center, Birmingham MS
Winkler, Dr. Charles H., Jr., University Medical Center, Birmingham MS
Winsor, Dr. Carlton W., 3700 The Cedars, Spring Hill Sta. Mobile BS-MS
Wintter, J. E., Howard College, Birmingham MS
Wood, George W., Jr., Route 2, Box 14, Cottondale
Woods, James W., University Medical Center, Birmingham 3
Woolley, Mrs. Carolyn W., Box 287, Ashville Road, Montevallo SE
* Yancey, Patrick H., Spring Hill College, 3669 Old Shell Rt., Mobile BS
Yackzan, Kamal S., Alabama College, Montevallo BS-C-MS
** Yates, Robert D., 2529 Park Lane Circle, Birmingham MS
Yerby, Miss Gail, 2030 Highland Ave., Apt. C-3, Birmingham 5 BS-SE
Yeager, Dr. Joseph H., Auburn University SS
Yocom, Herbert A., 315 16th Street, S. W., Birmingham FGC
Youngblood, Robert W., 626 South 54th Street, Birmingham SE
Zallen, Dr. Harold, P. O. Box 1210, Auburn C

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
HOWARD COLLEGE
BIRMINGHAM, ALABAMA

VOLUME 33 APRIL, 1962 NUMBER 2

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 33 APRIL, 1962 NUMBER 2

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

Complete Papers

Some Significant Recent Changes in the Pattern of Coal Production and Markets in Alabama

Reynold Q. Shotts
University of Alabama

INTRODUCTION

Although the rate of production of coal in Alabama has been relatively stable since 1949, the industry has undergone profound changes in markets, production, geography and size of production unit during the post-World War II period. The present report describes some of these changes by means of certain significant statistics.

Figure 1 shows the general location of the principal Alabama mines. This map has approximately the same base as a now obsolete map used in several Bureau of Mines publications [1, 2]. A comparison of Figure 1 with the old map shows no great shift in mining localities but does reveal the decline of the Cahaba field as a coal producer and the closing of many large—or medium—sized mines outside the coking-coal area. Most of the large coking-coal mines shown on the old map are still producing; however, several have declined sharply in recent years.

The statistics used to show the trends in the Alabama coal industry are from two sources. The items in Table 1, which are also shown graphically in Figures 2 and 3, were compiled from the *Annual Statistical Reports* of the Division of Safety and Inspection, Department of Industrial Relations, State of Alabama [3]. Statistics presented in Table 2 and shown graphically in Figure 4, were compiled from the *Minerals Yearbook* [4].

The statistics from the *Annual Statistical Reports* of the Alabama Department of Industrial Relations are for the state fiscal year, October 1 to September 30, and do not cover exactly the same period of time as those from the *Mineral Yearbook* which are on a calendar year basis. In few cases, however, is the three months displacement likely to affect comparisons of related items.

Statistics selected for discussion are those most indicative of the alterations in and the adaptability of the Alabama coal industry during the post-war period of rapid industrial change.

DISCUSSION

Table 1 and Figures 2 and 3, show that total state coal production dropped to approximately 12 million tons in 1949-50 and has averaged about 12-3 million tons annually since that year. In other

TABLE 1. Production Statistics For Coal Bed Groups, Fields and Principal Counties, 1946-47 to 1959-60.

Source: *Annual Statistical Reports*, Division of Safety and Inspection, Department of Industrial Relations, State of Alabama.

	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53
Total state coal production, thousands of tons	17,881	19,113	14,335	12,034	14,074	11,717	12,664
Production from railroad-connected mines, M's tons	15,192	15,462	11,833	9,874	11,779	9,800	10,714
Production from railroad-connected mines, percent of total	85.0	80.9	82.5	82.0	83.7	83.6	84.6
Production from Warrior field, M's tons	15,255	17,024	13,062	10,563	13,369	11,114	12,054
Production from Warrior field, percent of total	85.3	89.1	91.1	87.8	95.0	94.8	95.2
Production from the five largest mines, M's tons .	3,509	3,751	3,628	3.096	4,669	4,113	4,955
Production from the five largest mines, percent of total	19.6	19.6	25.3	25.7	33.2	35.1	39.1
Production from the Black Creek group of beds, M's tons	2,543	2,911	1,484	1,279	1.873	1,694	1,331
Production from the Black Creek group of beds, % of total	14.1	15.2	10.4	10.6	13.3	14.5	10.5
Production from the Mary Lee group of beds, M's tons	6,859	7,446	5,353	3.989	4,203	3,460	3,574
Production from Mary Lee group of beds, percent of total	38.4	39.0	37.3	33.1	29.9	29.5	28.2
Production from the Pratt group of beds, M's tons	5,281	5,214	4,903	4,482	6,473	5,475	6,442
Production from the Pratt group of beds, percent of total	29.5	27.3	34.2	37.2	46.0	46.7	50.9
Prduction from the Broookwood group of beds, M's tons	635	770	659	531	725	501	672
Production from Brookwood group of beds, percent of total	3.6	4.0	4.6	4.4	5.1	4.3	5.3
Production from Jefferson County, M's tons	9,036	9,247	8,526	7,220	9,039	7,300	8,504
Production from Jefferson County, percent of total	50.5	48.4	59.5	60.0	64.2	62.3	67.2
Production from Marion County, M's tons	353	429	333	268	315	334	286
Production from Marion County, percent of total	2.0	2.2	2.3	2.2	2.2	2.9	2.3
Production from Tuscaloosa County, M's tons	635	770	659	531	725	501	578
Production from Tuscaloosa County, percent of total	3.6	4.0	4.6	4.4	5.1	4.3	4.6
Production from Walker County, M's tons	5,424	6,043	2,859	2,256	3,161	3,026	2,772
Production from Walker County, percent of total	30.3	31.6	19.9	18.8	22.5	25.8	21.9

(Continued on next page)

(Continued) TABLE 1. PRODUCTION STATISTICS FOR COAL BED GROUPS, FIELDS AND PRINCIPAL COUNTIES, 1946-47 TO 1959-60.

Source: *Annual Statistical Reports*, Division of Safety and Inspection, Department of Industrial Relations, State of Alabama.

	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60
Total state coal production, thousands of tons	10,597	12,120	12,891	13,070	11,287	11,538	13,108
Production from railroad-connected mines, M's tons	9,134	10,302	10,769	11,817	10,033	10,395	11,424
Production from railroad-connected mines, percent of total	86.2	85.0	83.5	90.4	88.9	90.1	87.1
Production from Warrior field, M's tons	10,120	11,737	12,398	12,761	10,892	11,513	12,645*
Production from Warrior field, percent of total	95.5	96.8	96.2	97.6	96.5	99.8	96.5
Production from the five largest mines, M's tons	4,376	5,200	5,392	6.270	5,479	5,306	5,530
Production from the five largest mines, percent of total	41.3	42.9	41.3	48.0	48.5	46.0	42.2
Production from the Black Creek group of beds, M's tons	1,106	1,266	1,520	1,077	1,096	1,214	1,120*
Production from the Black Creek group of beds, % of total	10.4	10.4	11.8	8.2	9.7	10.5	8.5
Production from the Mary Lee group of beds, M's tons	2,603	2,733	2 928	3.007	2,255	2,704	3,600*
Production from Mary Lee group of beds, percent of total	24.6	22.5	22.7	23.0	20.0	23.4	27.5
Production from the Pratt group of beds, M's tons	5.809	7.061	7,142	7.827	6.807	6,275	6,900*
Production from the Pratt group of beds, percent of total	54.8	58.3	55.4	59.9	60.3	54.4	52.6
Production from the Brookwood group of beds, M's tons	576	580	639	584	694	733	754*
Production from Brookwood group of beds, percent of total	5.4	4.8	5.0	4.5	6.1	6.4	5.8
Production from Jefferson County, M's tons	7,144	8,204	8,461	8,983	7,178	7.166	7,925
Production from Jefferson County, percent of total	67.4	67.7	65.6	68.7	63.6	62.1	60.5
Production from Marion County, M's tons	282	361	603	220	241	220	260
Production from Marion County, percent of total	2.7	3.0	4.7	1.7	2.1	1.9	2.0
Production from Tuscaloosa County, M's tons	596	580	639	584	694	733	754
Production from Tuscaloosa County, percent of total	5.6	4.8	5.0	4.5	6.1	6.4	5.8
Production from Walker County, M's tons	2,156	2,479	2 538	2,745	2,716	2,803	3,566
Production from Walker County, percent of total	20.3	20.5	19.7	21.0	24.1	24.3	27.2

* No table of distribution of truck mine coal, by beds, was included in mine inspection reports. These figures were estimated.

words, during the period far enough removed from World War II to practically free coal production from the direct effects of that conflict and of the immediate post-war readjustment, Alabama coal production has been relatively stable in spite of profound changes in some of its markets. In 1950-51 production rose 15 percent above the average for the period under discussion and in the recession year, 1953-54, sank 13 percent below the average. These figures represent the maximum deviations in production rate during the eleven year period.

As in other coal producing states, but perhaps to a greater extent than in most, Alabama coal has lost to competing fuels a railroad fuel market, a great part of a domestic market and much of its commercial and industrial fuel markets. The proximity of the Alabama coal fields to the rapidly developing Gulf Coast natural gas areas probably has been the principal factor in the rapid loss of these markets. The bright spot in the market picture for Alabama coal is the rapid growth of the electric utility coal market.

About 85 percent of the state's coal production came from the

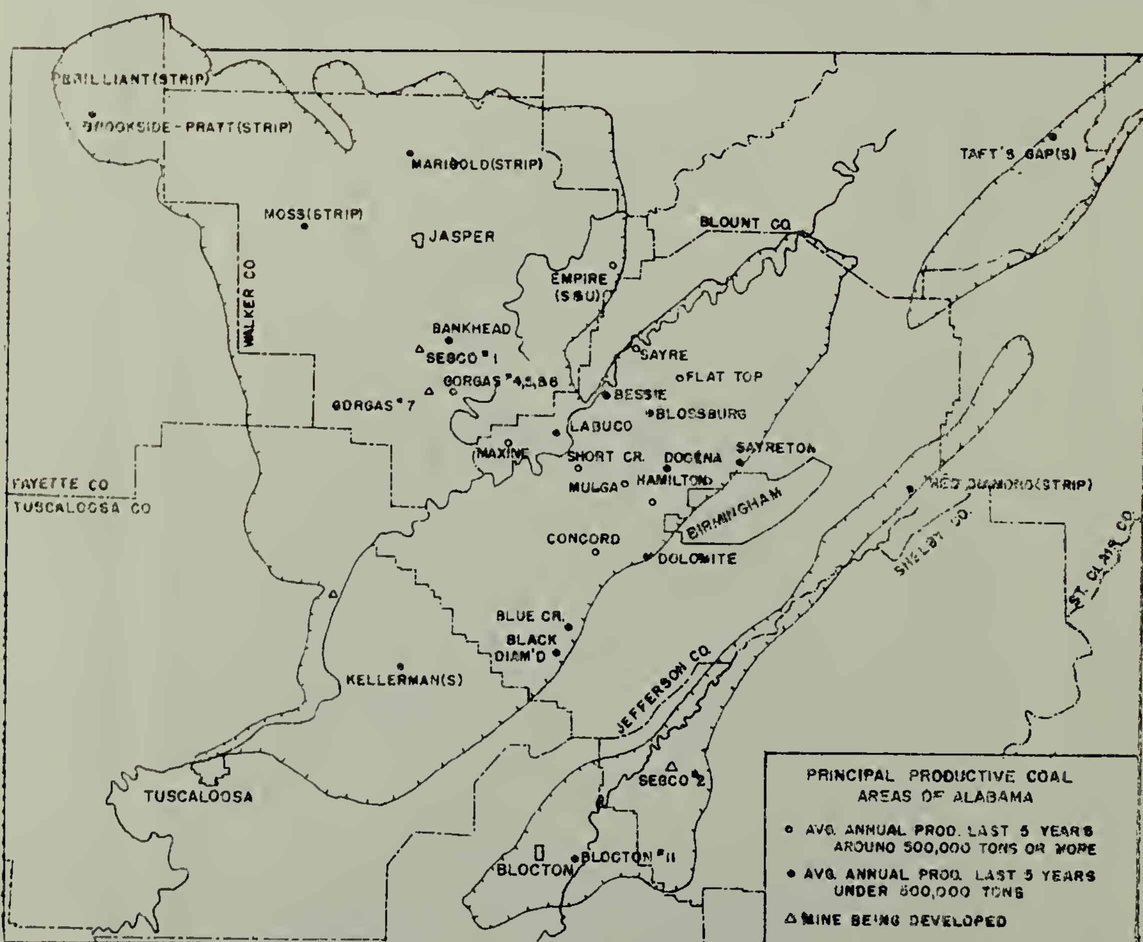


Fig. 1—Principal Productive Coal Areas of Alabama

Warrior field in 1946-47. By 1950-51, the percentage had increased to 95 percent and since that time it has continued to increase very slowly (Figure 3). The decrease in 1959-60 resulted from coal production at SEGCO No. 2 mine, in the Cahaba field. The percentage shown for 1958-59 is disproportionately high because for the first time, the *Annual Statistics Reports* did not separate Blount County production into that from the Black Creek bed in the southwestern part of the county (Warrior field) and that from Black Creek or Underwood bed in the Blount Mountain district, which may or may not be the same bed but which had nevertheless been classified as Plateau field in the compilations for all preceding years. Until 1950-51, production from the Cahaba field was appreciable but it has greatly decreased since then and at present the only appreciable production outside the Warrior field, is that from Blount Mountain area and from the new SEGGO No. 2 mine, as noted. The Coosa field historically has produced little commercial coal.

Figure 2 shows a close parallelism between the rate of production of coal from the entire state, from the Warrior coal field and from the railroad-connected mines. Figure 3 shows that railroad-connected mines have slowly increased their share of production as small trucking operations have decreased in importance and large, new railroad-connected mines, both underground and strip, have

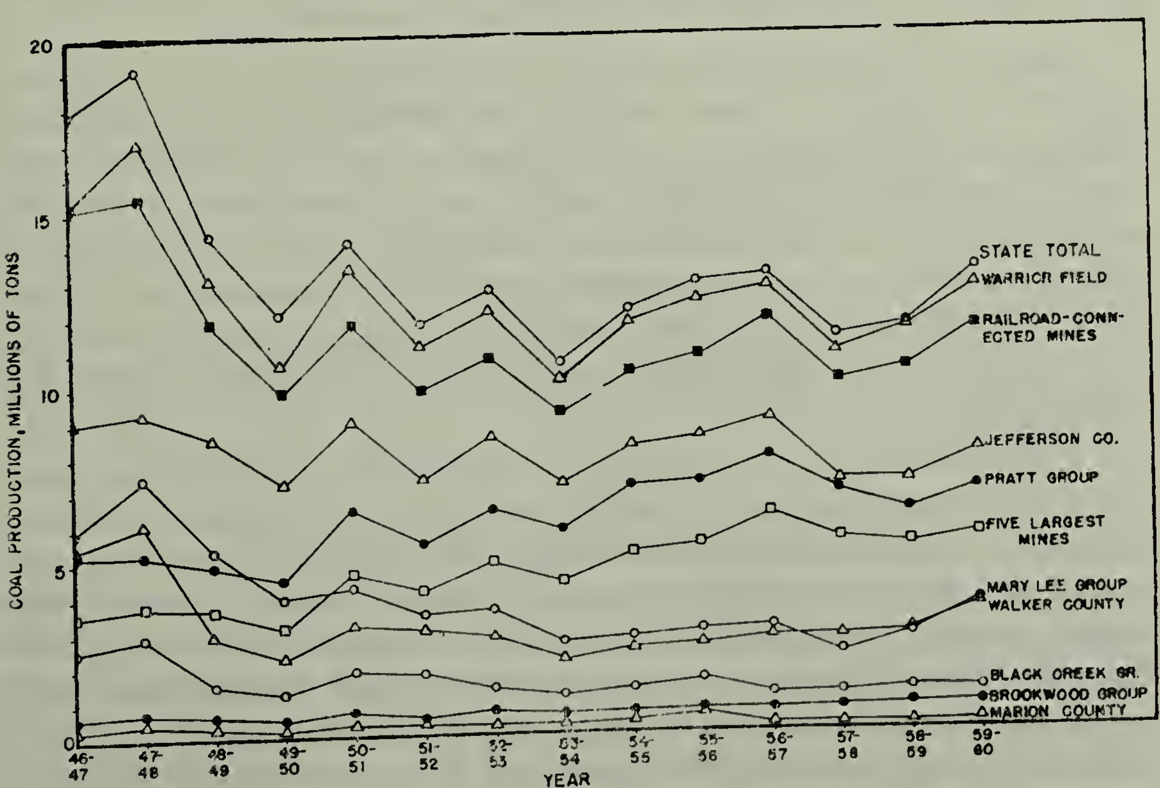


FIG. 2 - PRODUCTION OF COAL IN ALABAMA

been developed.

At least two fairly large strip mines ship coal exclusively by water and partly by rail and one very large underground mine also uses both modes of transportation. As the Black Warrior River is developed, waterborne coal traffic may become quite important within the state but is not likely to displace the railroad as the principal method for coal transportation.

Among the counties, Jefferson, with an average production of approximately 8 million tons per year is, by a large margin, the leading coal producer. It is the only county reporting coal production from both the Warrior and Cahaba fields, although the latter production has been insignificant since 1949-50 and was only about 35,000 tons that year. The 1958 "recession," the 1959 steel strike and the subsequent slowness of steel production recovery may account, partly, for the lowered Jefferson County coal production for the last three years. Another factor may be the near depletion of some large "captive" mines and the closing of some commercial mines in the county.

Until the mid-1950's, Jefferson County coal production was tied very closely to the iron and steel industry although some commercial coal was sold by "captive," but non-steel, companies. Since that time, one of the largest mines in the state has gone into production in the county, mining electric utility fuel exclusively.

Walker County coal production declined nearly every year from 1946-47 to 1957-58. Since 1952-53, the annual county production rate has averaged about 2½ million tons of which probably somewhat more than half is electric utility coal. Two mines, each producing in excess of one million tons of electric utility coal, have been recently developed and, along with strip mining, may raise Walker County production to pre-1950 levels within a few years. The effects of production from these mines can be seen in the figures from the last 2 years.

Coal production in Tuscaloosa and Marion Counties has been practically unchanged since 1946-47, with that for Tuscaloosa County showing a slight upward trend within the last few years and that for Marion County, a slight downward trend. Partly due to accessibility to Gulf Coast utility electric generating plants via the Black Warrior River, Tuscaloosa County is in a good production-growth position. Marion County, in spite of its fair proximity to TVA's Colbert electric plant on the Tennessee River, is still too distant to compete, in mining and transportation costs, with river-borne Ken-

tucky and Illinois coals. Consequently, its production is not likely to increase in the near future.

Because, in general, the productive beds are productive in roughly the same counties and parts of counties, county statistics reflect far less change in production distribution than do bed statistics.

The production of coal from the Pratt group of beds (Pratt,

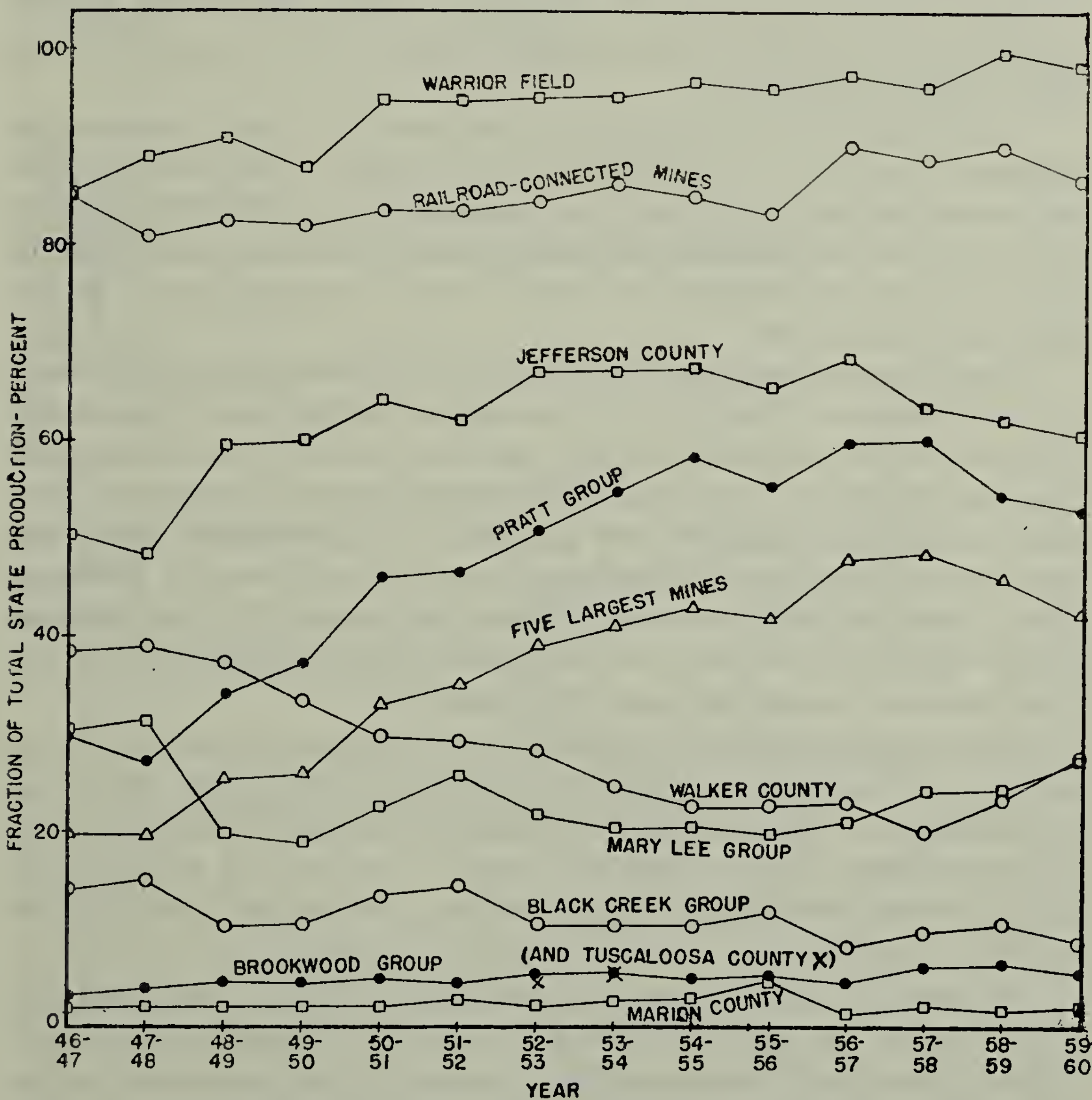


FIG. 3 - RELATIVE PRODUCTION OF COAL IN ALABAMA

America, and to a small extent, Nickel Plate and Corona) has risen steadily by percentage of total state coal production, during the period under study. The apparent drop since 1958-59 can be ascribed to the slow recovery in steel production as the Pratt group of beds produces by far the greater part of the coking coal in Alabama. The America bed has been the principal gainer in the group

and in 1959-60, the largest coking-coal mine and the two largest utility coal mines in the state were operating on this bed. Two are relatively new mines, and all three have been opened within the post-World War II period.

The production history of the Mary Lee group of beds is opposite to that of the Pratt group. The Jagger, Blue Creek, Mary Lee, and Newcastle beds of the Mary Lee group have all contributed to commercial mining, but the Mary Lee (designated "Big Seam," in some areas) is and has been the big producer with the Blue Creek bed a distant runner-up.

It can be seen from Figure 2 that Mary Lee group production exceeded that of the Pratt group until 1949-50. The average production of the Mary Lee group has decreased about 200,000 tons per year while production from the Pratt group increased nearly 500,000 tons per year from 1949-50 to 1956-57, with a drop-off noted in the latter since that time.

The Mary Lee bed has both coking and steam-coal mining areas. It still furnishes a fairly large tonnage of coking coal, practically all from within Jefferson County; however, most of the coking-coal mines on the Mary Lee bed are old and only 2 or 3 have ever produced as much as 500,000 tons per year. A prospecting shaft has been sunk to the Mary Lee bed farther to the southwest in Jefferson County than the bed has never before been mined. If this develops into a large mine, the Mary Lee bed should regain much of its former importance as a producer of coking coal.

The Mary Lee bed in non-coking-coal areas was formerly a large producer of steam coal, industrial coal and railway fuel. The loss or shrinkage of these markets accounts for most of the Mary Lee bed production loss in Walker County. One of the large utility mines recently developed in that county, mentioned above, is on the Mary Lee bed.

Production from the Black Creek group (Black Creek and Jefferson beds) has also decreased during the period under study. Although the Black Creek outcrop is nearest to the Tennessee Valley, for practical purposes, little of its present production is actually available to either the TVA or to private utility markets. Very little Black Creek bed coal is used for coke making. The market is thus limited to industrial, commercial and domestic fuel and prospects are not bright for any great increase in production within the next few years. The Black Creek and Jefferson beds are prevailingly thin and it is likely that production from them would have declined even more except that they yield high grade coal and are the lowest

and hence the peripheral group of the Warrior field with a rather long outcrop line conducive to strip mining.

Only strip mining is now practiced on the Brookwood group (Brookwood, Milldale, and to a small extent, Carter beds) and only steam or industrial coal is produced. Production for the Brookwood

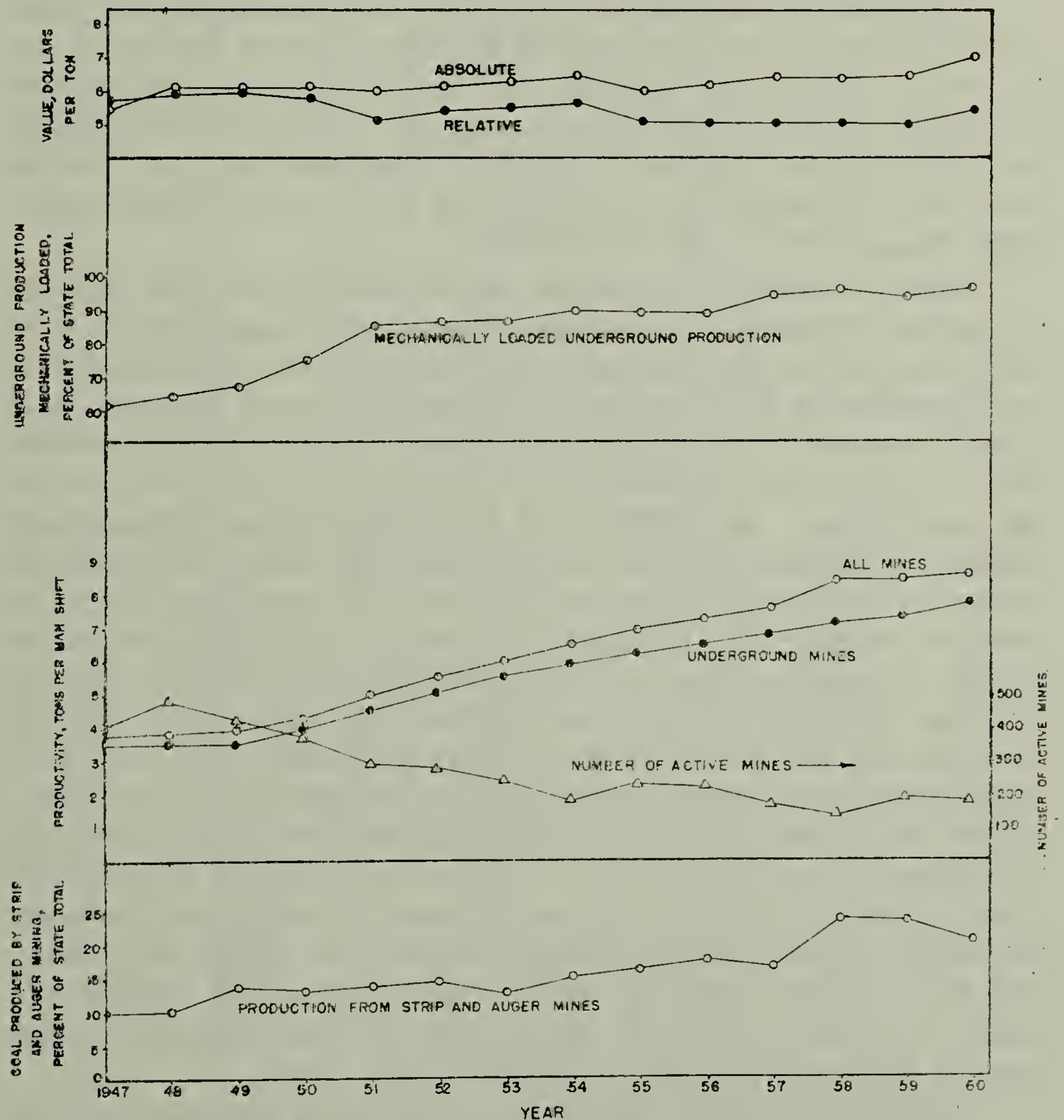


FIG. 4 - FACTORS RELATED TO PRODUCTION OF COAL IN ALABAMA

group and Tuscaloosa County were identical except for 1952-53 and 1953-54.

The development of new mines may again change the coal production pattern for Alabama but probably not for several years. In addition to the two electric utility fuel mines, one on the Mary

Lee bed and one on the America, a new mine for electric utility coal on the Montevallo bed gives promise of bringing the Cahaba coal field back into the Alabama coal production picture. Also, the Mary Lee bed experimental shaft, mentioned above, may add coking-coal capacity.

The steady concentration of Alabama coal production into fewer and larger units is also emphasized in Table 1 and in Figures 2 and 3, which indicated the tonnage and the percentage of total state production mined by the five largest mines. Both increased 1946-47 to 1957-58. The decrease since that time has been due to the relatively low production of coking coal, most of which comes from large mines, some of them quite old.

Table 3, showing the names of the mines, the beds and the production for each year, reveals some of the changes which have occurred. In 1946-47, all five of the largest mines produced coking coal, although at least one also produced some coal for steam and other purposes. The largest production was from the Hamilton mine, on the Mary Lee bed. One other mine on this bed was in the top five list. In 1958-59, the two largest mines, Maxine and Gorgas, on the America bed, produced electric utility fuel while the other three produced coking fuel. In 1960 Concord and Edgewater produced coking coal. In that year Segco No. 1 "crashed" the select group producing utility fuel from the Mary Lee bed, and for the first time three of the top five mined electric utility coal. Preliminary figures for the fiscal year ending September 30, 1961, indicate that the three largest mines in the state produced just over four million tons of electric utility fuel. The next two largest produced 1.8 million tons of coking coal[5]. Empire mine, of the Black Creek group, is the only strictly commercial mine to make the list during the entire 14-year period, although some of its output was coked. The first electric utility fuel mine to place among the top five was Gorgas in 1950-51 and one, two or three utility fuel mines have been in this category every year since that time.

Table 2 and Figure 4 show certain important statistics from the *Minerals Yearbooks*. As stated earlier, the periods covered by each of the figures in Table 2 are displaced 3 months later than the corresponding figures of Table 1.

The trend toward concentration of Alabama coal production into larger units is shown by the number of active mines within the state, 378 in 1950 and only 141 in 1958. The average production per mine was approximately 32,000 tons in 1950 and 82,000 tons in 1958.

TABLE 2. NUMBER OF COAL MINES, EXTENT OF STRIP MINING, PRODUCTIVITY, AND VALUE OF COAL, 1947-58.

Source: *Minerals Yearbook*, United States Bureau of Mines

	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Productivity per man per shift for all mines, tons	3.81	3.77	3.87	4.31	5.00	5.53	6.03	6.54	6.89	7.29	7.61	8.40	8.48	8.66
Productivity per man per shift for underground mines, tons	3.56	3.52	3.55	3.98	4.60	5.11	5.64	5.99	6.25	6.52	6.85	7.17	7.34	7.80
Number of active mines	406	484	426	378	298	287	248	188	235	225	171	141	187	177
Coal produced by strip and auger mining, percent of state total	10.2	10.3	13.8	13.1	13.9	14.5	12.9	15.0	16.1	17.8	16.4	23.7	23.2	20.3
Absolute value of coal at mines, dollars per ton	5.48	6.15	6.12	6.13	6.06	6.22	6.33	6.55	6.06	6.26	6.49	6.47	6.55	7.10
Relative value of coal at mines, dollars per ton[1]	5.75	5.95	6.04	5.84	5.23	5.49	5.55	5.72	5.18	5.12	5.17	5.13	5.11	5.53
Underground coal production mechanically loaded, percent of state total	61.9	64.6	67.2	75.6	85.7	86.7	86.6	89.6	89.3	88.9	94.1	95.8	94.0	96.5

[1] Based on wholesale prices for all commodities except foods and farm products, 1947-49=100.

TABLE 3. Production From the Five Largest Mines Since Fiscal Year 1946-1947.

Year	Mine	Bed	Annual Production
1946-47	Hamilton	Mary Lee	876,845
	Edgewater	Pratt	813,732
	Praco	Mary Lee	686,201
	Mulga	Pratt	569,438
	Docena	Pratt	563,190
1947-48	Edgewater	Pratt	1,047,416
	Praco	Mary Lee	796,140
	Hamilton	Mary Lee	710,748
	Empire	Black Creek	649,994
	Parrish	Mary Lee	546,891
1948-49	Edgewater	Pratt	1,068,832
	Praco	Mary Lee	725,260
	Short Creek	Pratt	632,889
	Hamilton	Mary Lee	629,313
	Docena	Pratt	571,924
1949-50	Edgewater	Pratt	842,312
	Hamilton	Mary Lee	592,928
	Short Creek	Pratt	587,362
	Concord	America	544,026
	Docena	Pratt	528,934
1950-51	Concord	America	1,224,618
	Edgewater	Pratt	1,207,822
	Mulga	Pratt	796,742
	Docena	Pratt	743,438
	Gorgas	America	696,696
1951-52	Concord	America	1,176,536
	Edgewater	Pratt	878,990
	Gorgas	America	857,060
	Mulga	Pratt	699,331
	Docena	Pratt	501,160
1952-53	Concord	America	1,399,989
	Edgewater	Pratt	1,124,283
	Gorgas	America	953,758
	Mulga	Pratt	816,412
	Short Creek	Pratt	660,897

(Continued on next page)

TABLE 3. PRODUCTION FROM THE FIVE LARGEST MINES SINCE FISCAL YEAR 1946-1947.

(Continued)

Year	Mine	Bed	Annual Production
1953-54	Concord	America	1,213,806
	Edgewater	Pratt	958,152
	Gorgas	America	951,016
	Mulga	Pratt	705,041
	Short Creek	Pratt	548,328
1954-55	Concord	America	1,453,589
	Gorgas	America	1,258,274
	Edgewater	Pratt	1,083,527
	Mulga	Pratt	852,361
	Flat Top	Mary Lee	551,781
1955-56	Concord	America	1,460,238
	Gorgas	America	1,443,940
	Maxine	America	871,542
	Mulga	Pratt	825,590
	Edgewater	Pratt	790,361
1956-57	Concord	America	1,670,708
	Gorgas	America	1,612,630
	Maxine	America	1,227,194
	Edgewater	Pratt	1,047,404
	Sayre	Mary Lee	711,885
1957-58	Gorgas	America	1,408,190
	Maxine	America	1,368,098
	Concord	America	1,272,515
	Edgewater	Pratt	834,470
	Sayre	Mary Lee	595,534
1958-59	Maxine	America	1,510,479
	Gorgas	America	1,484,631
	Concord	America	874,739
	Mulga	Pratt	736,238
	Edgewater	Pratt	699,956
1959-60	Maxine	America	1,403,184
	Concord	America	1,311,212
	Gorgas	America	1,174,306
	Edgewater	Pratt	868,263
	Segco No. 1	Mary Lee	772,705

Since 1949, the annual increase in productivity has averaged about 0.38 tons per man per shift. Productivity of strip and auger mines is considerably higher than that for underground mines and the slow increase in the percent of the state's coal output which is mined by stripping accounts, in part, for the increase in productivity for all mines. There was a very sharp increase in the percent of strip and auger mined coal in 1958, although from 1949 to 1957 the increase averaged only about 0.32 percent per year.

Underground mining productivity has also increased quite rapidly since 1948 although since 1953 the rate of increase has slowed slightly. The average annual increase since that date has been about 0.31 percent per man per shift. Mechanization of the coal mines has proceeded steadily during the entire period as shown by the figures for percent of underground production loaded mechanically. It is evident that future increases in productivity must come, not from more mechanization, but from improved mechanization of already mechanized mines.

If the present rate of increase could be maintained, productivity in 1970 from underground mines would be about 10 tons per man per shift.

Because of the general increase in wholesale prices and the consequent increased costs of mining and preparing coal since 1947, an increase in the value of coal at the mine would be expected. No doubt largely due to the increases achieved in productivity, such has not been the case. The average increase in the dollar value of Alabama coal, 1949-59, has been about 3½ cents per ton per year. Relative to other wholesale prices, the value has actually decreased. As shown in Table 2 and Figure 4, if the average value of a ton of Alabama coal for each year since 1950 is divided by the wholesale commodity price index (1947-49=100) for all commodities other than foods and farm products[6], the relative value has actually decreased from $5.84 per ton to $5.11 (1959) or an average of about 7 cents per ton annually. The rise in value noted for 1960 resulted in the greatest relative value change since 1954. It thus would appear that the coal industry in Alabama, as in other parts of the country, has been fairly successful in combating increasing costs by increased productivity and that technological and non-economic factors have played a large part in the invasion of coal markets by other fuels. That coal has been able to preempt the utility fuel market and to expand production so markedly in that direction, demonstrates further that solid fuel producers have been successful in maintaining competitive costs.

Not only has the identity of the coal beds mined tended to change since World War II but their character also has changed. Indeed, character and location probably are the leading reasons for change in beds selected for mining. Table 4 [7, 8, 9] shows the thickness of bed mined, the thickness of overburden stripped, the refuse content and the extent to which mechanical cleaning has been practiced for four selected years. Obviously the trend is in the direction of thicker, but "dirtier" beds and of even more mechanical cleaning. Of course, the increase in the number and thickness of partings in the thicker coal beds mined and in the use of mechanical methods have contributed to the increase in refuse content of the raw coal. It is not possible to assess properly the relative importance of these two factors.

TABLE 4. Bed Thickness, Overburden Thickness and Coal Quality for Selected Years (Minerals Yearbook Data)

Year	1945	1950	1955	1959
Ave. thickness of coal seam mined, feet	3.9	4.0	4.6**	—
Ave. thickness of coal seam strip mined, feet	3.9*	3.3	3.2	—
Ave. thickness of coal seam underground mined, feet	4.0	4.1	4.4	—
Ave. thickness of overburden stripped, feet	24.7*	25.0	47.4	—
Percent refuse was of raw coal	20.9	27.6	36.8	35.9
Percent of total production mechanically cleaned	75.8	80.1	87.6	90.4

* 1946

** At one auger mine the bed averaged 8 feet thick.

REFERENCES

1. Hertzog, E. S., Cudworth, J. R. and Selvig, W. A., Friability, Grindability, Chemical Analyses and High-and Low-Temperature Carbonization Assays of Alabama Coals: Bureau of Mines Technical Paper 611, 1940, 59 pp.

2. Gandrud, B. W., and Coe, G. D., Drainage Characteristics of Alabama Coals: Bureau of Mines Report of Investigations 3563, 1941, 27 pp.

3. Annual Statistical Reports: Division of Safety and Inspection, Department of Industrial Relations, State of Alabama, 1946-47 to 1957-58.

4. Bureau of Mines, Minerals Yearbook: 1947 to 1959.

5. Quarterly Report (Mimeographed): Division of Safety and Inspection, Department of Industrial Relations, State of Alabama, September 30, 1961.

6. Statistical Abstract of the United States: U.S. Department of Commerce, 1961.

7. Young, W. H. and Anderson, R. L., Thickness of Bituminous and Lignite Seams Mined in the U.S. in 1945. Bureau of Mines Information Circular 7442, 1947, 17 pp.

8. Young, W. H. and Anderson, R. L., Thickness of Bituminous Coal and Lignite Seams Mined in the United States in 1950. Bureau of Mines Information Circular 7642, 1952, 18 pp.

9. Young, W. H. and Anderson, R. L., Thickness of Bituminous Coal and Lignite Seams Mined in the United States in 1955. Bureau of Mines Information Circular 7812, 1957, 11 pp.

Rotary Bucket Drilling Replaces Churn Drilling in Russellville Brown Iron Ore District

Jack E. Morris
U. S. Pipe and Foundry Company

The Russellville, Alabama, Brown Iron Ore District can be divided into the northeastern area, and the southwestern area. The northeastern area is considered here.

For many years the mining of brown iron ore in the northeastern area was a fairly simple problem. This was a consequence of the type of ore deposits found here. The bulk of the ore was of secondary origin, that is, confined to areas of red dirt. These red dirts, for the most part, were ore bearing, containing "float type" ore.

Just as mining was uncomplicated, so was the exploration. Crews of test-pit diggers were able to develop ore deposits ahead of mining, because ore occured in pockets and outcropped at the surface. There was no problem involved in deciding where to test. Nine times out of ten, if no ore occurred in red dirt on the surface, the area was barren and no testing needed to be done. Test-pitting was done in these ore bodies mainly to determine the thickness of workable ore.

After the exhaustion of these red dirt deposits, it became necessary to adopt means of locating primary deposits under gravel and conglomerate overburden. Test pitting was obviously too slow and dangerous in loose gravel of more than 20 to 30 feet in thickness. Therefore, churn-type drilling was adopted. Churn-drilling was faster and safer than the old hand method and for several years was used in the northeastern areas for locating many primary deposits.

Churn-drilling required a special stardardized sampling technique. The first five feet was drilled and was considered the first sample. A five foot joint of casing was then driven, the hole cleaned out, and the next two and a half feet drilled. This was sampled. Casing had to be added, and driven to seven and a half feet. Then the hole had to be cleaned out before the next two and a half foot sample could be drilled. This procedure was repeated until bedrock was reached.

The disadvantage of this method is that the sampling is limited to 2½ foot intervals, and when ore is reached, no definite measurement can be obtained as to the top of the ore. In most cases the first sample which shows ore is mixed with gravel. The result is usually

the same when the lower limit of the ore horizon is reached, although in this case the sample is ore and clay. The sampling method could be improved, to be sure, by taking shorter sample intervals, but the time involved in doing so would be prohibitive.

Churn-type drills were usually the track-mounted, self-propelled type. These were blast hole machines, with no auxiliary lines for handling casing. They moved slowly from one hole to another, and for long moves, required the hire of a low-boy.

Each drill needed 100 feet of casing, water barrels and sludge sample tubs. After each hole was completed, the casing was pulled and used again in the next hole. All of this material had to be moved each time the drill completed a hole. Each month, many man hours were consumed just in the moving process.

With the drills, it was necessary to have one water truck with each two drills, tho, if the weather were favorable one truck could service three drills not too widely scattered. During winter months, trucks were abandoned, and a team of mules and wagon furnished each drill.

It also was necessary to maintain a large inventory of casing, couplings, cables, bits and fishing tools. The bits were built up with an undercoat of workhardened rod, topped with a special hard rod. This work kept a welder busy nearly full time when we operated a maximum of five churn-drills.

This then, was the equipment in use when we began our exploratory work in virgin territory in the southwestern area of the Russellville district.

From 1950 until 1956 churn-drilling was done on several properties in the southwestern areas. We became alarmed at the results and inaccuracy of the drilling and sampling when we started stripping some of the so-called proven deposits. Churn-drilling breaks up the ore into rather fine cuttings, particularly if drilling is done under a large column of water. These cuttings did not give an accurate analysis when compared with actual ore mined. Mill feed averaged 2% higher in iron content than the drill cuttings. We also found, that blank areas within an ore body were merely small columns of gravel. Or, on the other hand, thin ore columns were surrounded by wide blank areas.

Because of the facts outlined above, we were on the alert to find some drilling method which would give faster and more accurate results. Thus we discovered a rotary-bucket drill, developed in California for sampling gold placer deposits, similar to the unconsolidated material in the Russellville district.

Arrangements were made to visit an operation in the manganese district near Vesuvius, Virginia, and see this drill in action. I was impressed with the speed and accuracy of the drill which was drilling a 36" diameter hole through boulders, clay, sands and massive manganese and arrangements were made to have this drill come to Russellville for a demonstration.

Early in January of 1956 this drill arrived and in 135 hours, 27 holes were drilled for a total of 1229 feet. Including moving time, this averaged 9.04 feet per hour. As a check, during the same period, one churn-drill completed 9 holes for a total of 480 feet.

The bucket drill is mounted on a tandem, 10 wheel truck. A single section 32 foot boom is raised and lowered by two hydraulic cylinders. One guy line and a turn buckle are all the support necessary, and the top of the boom may be swung in or out by adjusting the line and turn buckle. A separate power unit operates the hydraulic system, the double drum American hoist, and, through a reduction gear, the turn table which drives the rotary rods and bucket. We found that a speed of 12 to 14 RPM on the turn table was ideal for our type drilling. A kelly 22 feet long is of the telescoping type, and thus 44 feet can be drilled before an additional rod is needed. There is no mechanical pull down. Drilling is accomplished entirely by employing the weight of the tools, and by the pitch of the cutting teeth on the bucket bottom. Dumping is accomplished through the use of a small winch and side dumping arm.

On the basis of the demonstration we could find a dozen good reasons for purchasing a bucket drill.

1. Much faster drilling.
2. Truck mounted drill more mobile.
   a. Hydraulic lift boom requires seconds to raise and lower. Set up time reduced to minutes.
   b. Churn-drill boom manually lifted with hand winch. Auxillary rods and rope guides necessary. Set up time 30 to 45 minutes.
3. Standard length drilling tools enable driller to know at a glance the depth of the hole at any given time.
4. Actual measurement to the inch of overburden and ore thickness possible by lowering a man on a bosun chair into the hole.
5. Channel sampling possible if desired.

6. Ore samples cut by bucket similar to ore removed or dug from pit by drag line.

7. Ore samples check mine run material.

8. No water or water truck needed.

9. No casing needed.

10. No fishing tools required.

11. Inventory of tools and parts cut down.

12. 44 feet could be drilled before additional rods were needed.

Our first bucket drill was purchased, and put into operation in July of 1956. Accurate records were kept with the following results:

No. of Churn Drills	Month	Amt. of Drilling	Bucket
4	July	3,593	1071
4	Aug.	3,661	1613
4	Sept.	3,050	2118
4	Oct.	3,443	2092
3	Nov.	3,092	2339
3	Dec.	1,665	1750
		Totals 18,504	10983

In January 1957, the second bucket drill was placed in operation. We then began eliminating the churn-drills, and by 1958 no churn drills were in use.

During the period when we were operating both the bucket and churn drills, cost comparisons were kept, and I can say this: Bucket drilling cost less than the churn-drilling.

Chart No. 1 compares drilling done in 1953 and 1955 with churn-drills against drilling in 1959 and 1960 using two bucket drills. 1959, for economic reasons was not a full drilling year, whereas, 1953 and 1955 were normal work years.

Chart No. 2 compares churn and bucket drilling during the same periods as above. This shows the totals drilled by all equipment and the total number of holes drilled.

Chart No. 3 is a bar graph showing an average year comparison between one churn drill and one bucket drill. This graph shows that we have increased our exploration program on an average each year of 59.32%.

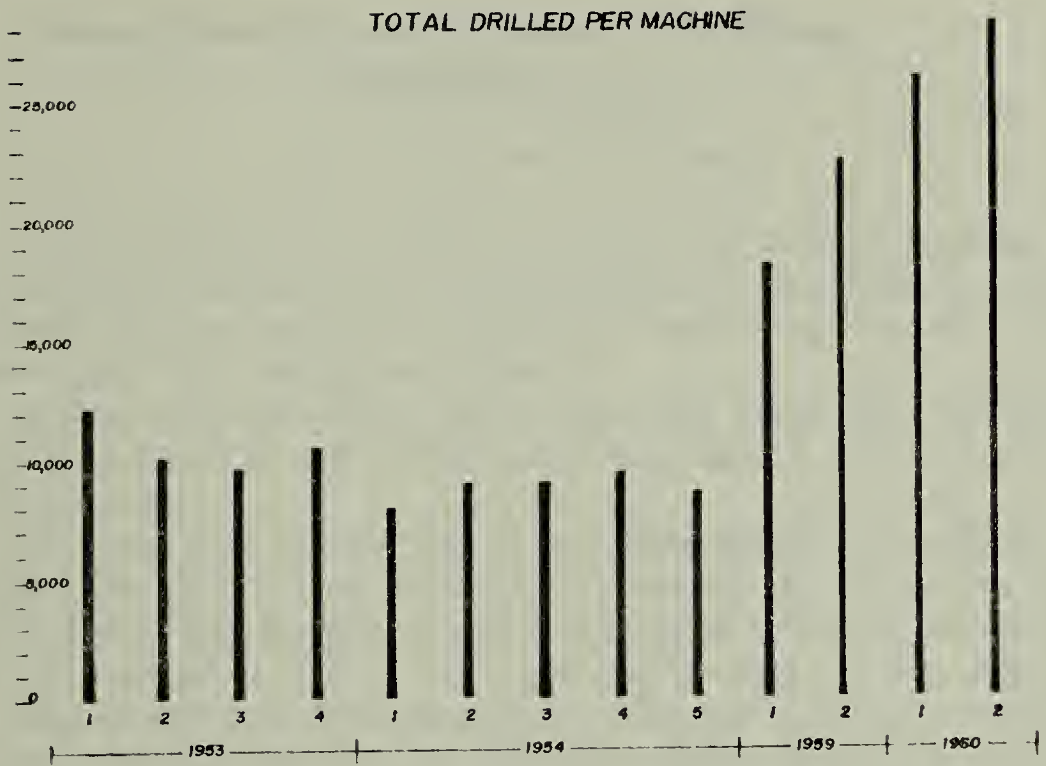


CHART 1

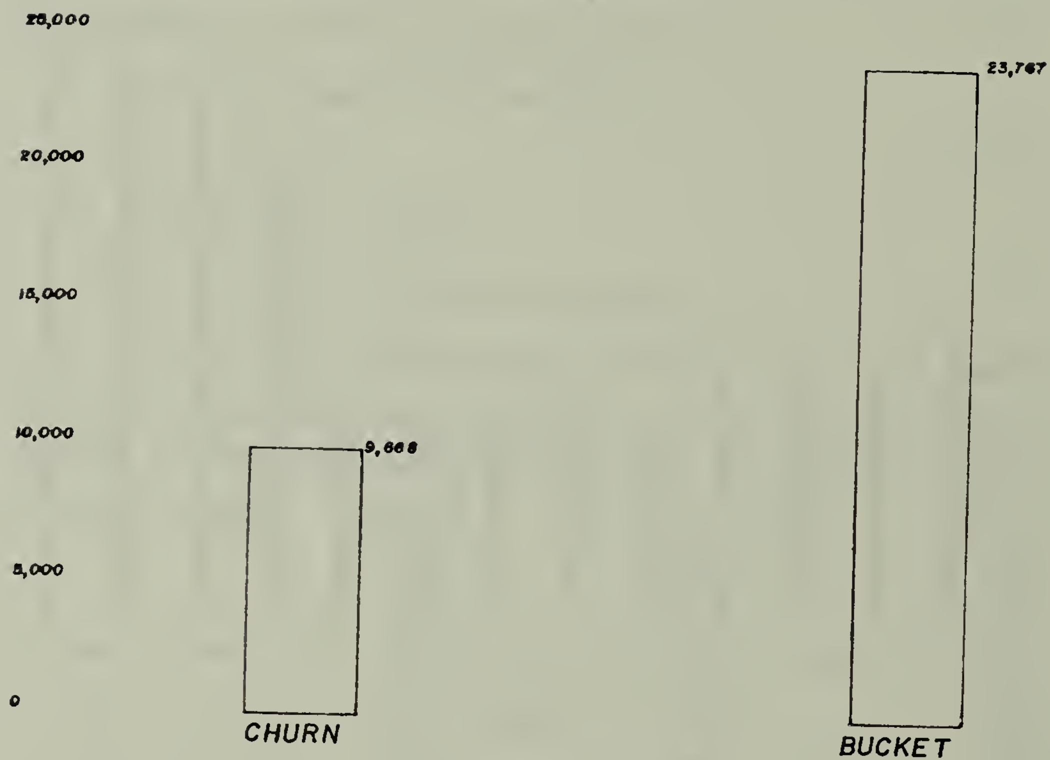
TOTAL DRILLED—ALL DRILLS

Type Drill	Year	No. of Drills	Total Footage	No. of Holes
Churn Drill	1953	4	42,637	482
Churn Drill	1955	5	44,075	764
Bucket Drill*	1959	2	40,811	1,161
Bucket Drill	1960	2	54,457	1,516

*Bucket Drills Operated From March 10th, 1959 to December 30, 1959

CHART 2

AVERAGE DRILLING PER YEAR, CHURN DRILL COMPARED TO BUCKET DRILL



INCREASE 59.32 %

CHART 3

Forest Tree Diseases in Alabama

William H. Padgett

Alabama Division of Forestry

In the last few years there has been a tremendous increase in the interest of forestry and forest products. Concurrent with this increased interest has come, I believe, a renewal of interest in the diseases that may affect our forests.

Diseases of forest trees will be of major importance in future years as a result of our increase in tree planting due to the Soil Bank Program.

All sizes, ages and species of trees are subject to damage by diseases, the same as they are subject to damage by fire and insects. I believe that this division of forest protection is just as important over any period of time as any other division that you may choose.

You do not have to be reminded of the fact that the American chestnut, *Castenea dentata,* has been removed from our forest, as a major timber species, as the result of a disease. This alone should be reminder enough of the havoc that may be caused by a single disease.

In 1934, in Tallapoosa County, Alabama, a strange malady was reported attacking shortleaf pine and has subsequently become known as littleleaf disease. This disease has not been completely solved to every one's satisfaction, though many theories have been advanced and extensive research has been carried out.

Studies of a more recent nature seem to indicate the cause to be a result of a combination of factors. The destruction of the growing root tips by the soil-borne fungus, *Pyhtophthora cinnamomi,* seems to be the most acceptable theory. The site conditions under which this species grows seem to predispose the tree to attack by the fungus. Under good site conditions extensive littleleaf is seldom encountered.

Littleleaf disease attacks shortleaf pine, primarily, but has been known to attack loblolly pine to a much lesser extent. Littleleaf disease coincides with the range of shortleaf pine from the upper Atlantic coast states into Mississippi. The most severe attacks have been in the Piedmont Region of the shortleaf pine range.

Cronartium fusiforme or southern fusiform rust remains the number one disease of southern pines. This disease attacks all ages of slash, loblolly, and to some extent longleaf pine. However, it is rarely encountered on shortleaf pine.

The water oaks are the primary alternate host of this disease even though other species of oaks are known to be susceptible.

In March or early April yellow spores are produced on the pine galls. These spores are wind blown to nearby susceptible oaks where yellowish pustules are developed on the lower surfaces of the leaves. Spores produced by these spots are capable of reinfecting other oaks thereby increasing the amount of inoculum on the oaks. Later telia horns are produced on the underside of oaks leaves and these produce sporidia which infect the pines.

Nursery stock can be protected by following a rigid spray program using ferbam, ziram, or zineb with a suitable sticker. However, control in plantations is quite difficult. The best rule of thumb to use here is to plant susceptible seedlings on sites conducive to their better growth.

The increase in infection of plantations in the last few years has been caused from planting such species as slash pine too far out of their natural range.

Another disease that has attracted much attention since its discovery in Florida in 1892 is the Southern Cone Rust caused by a species of *Cronartium.* This disease attacks the newly formed conelets of slash and longleaf pines shortly after pollination. Conelets that become infected during the latter part of March increase to 3 to 4 times the size of healthy conelets. The diseased cones are usually shed by late summer. Infected cones are heavily attacked by insects which later multiply and move into healthy cones causing a reduction in the amount of seed produced.

The cycle for this disease is somewhat different from that of Southern fusiform rust in that the build up of the rust on the oak leaves is during the summer and fall. The sporidia that infects the mature female pine flowers comes between mid-December and the end of February.

The primary host in the Gulf States is the live oak since it retains its leaves during autumn and the telia build up occurs during this time.

It is suggested that planned seed orchards be placed in areas outside of the most severe range of this disease.

Brown-spot needle blight is the most serious disease of longleaf pine seedlings. Damage is worst on seedlings in nursery beds and on planted or natural seedlings still in the grass stage. Seedlings that are heavily infected may linger in the grass stage for 10 years or more and may eventually die. It is quite difficult to establish stands of young seedlings where the disease flourishes unchecked.

Brown-spot has been found wherever longleaf pine grows in the United States. The hosts include at least 24 pine species, 10 of which are native to the Southeast.

Bordeaux mixture is used to control brown spot in nurseries.

Vigorous longleaf seedlings in the grass stage possess great ability to survive fire. Hence, carefully controlled burns of low intensity will scorch the needles, and thereby kill the fungus, without seriously damaging the seedlings.

Fomes annosus root rot has been the subject of much discussion during the last year or so and will undoubtedly be of more concern as more information is made available.

Fomes annosus was described as being on white pine on the Biltmore Estate of North Carolina some 20 years ago. It kills red cedar throughout the piedmont region. Slash pine and other southern pines are susceptible to this root rot.

The intensive management that has been advocated in the south the last few years favors infection by this fungus. *Fomes annosus* has been found to heavily infect a stand two to three years following a thinning. The primary source of infection is through freshly cut stumps. Root grafts are an excellent means by which this disease will travel from infected trees to healthy ones.

The information gathered from surveys along the Eastern coast of natural and planted stands showed very little difference between the two as far as this fungus is concerned.

Fomes annosus has been found in slash pine stands from North Carolina to East Texas. Loblolly does not seem to be quite so heavily infected as slash pine. There have been reports of longleaf being attacked, but to a lesser extent than slash or loblolly pine.

Information available so far indicates a relationship between thinnings, soil texture, and drainage. As further research is performed more concrete information will become available concerning these factors.

Fomes annosus has been recognized for some time as the most serious disease of forest trees throughout Europe. The British have been working on means of controlling infection through stumps, following thinnings. Their best information shows creosoting of stumps at the time of thinning as being the best control. There must not be a delay of one or two days because infection follows immediately behind the thinnings.

The spores of *Fomes annosus* present a problem for they have been trapped 200 miles from the nearest infection source. Spores are produced throughout the year by the conks. This disease has been

known to live for 40 years in stumps in Britain. However, it may live for only a few years in the Southeast. The conks usually appear within one year following infection.

The symptoms of *Fomes annosus* infection favor those associated with insect damage. Yellowing and thinning of the crown is noticeable. Defoliation of the lower limbs follows infection. Some times insects may infect a tree that has been weakened by this disease. However, insect outbreaks are considered to be a factor following disease infection.

Stands that have been established on cultivated soils seem more prone to attack than stands developed on land previously in woods.

Soil pH seems to be a factor that has to be considered in the spread and development of this fungus. Soil pH of 4.5 to 5.5 seems to encourage greater infection.

Some available information indicates pruning wounds are not important as a place of entrance for this disease. Bark hack tools used in the turpentine industry have been discounted as a carrier of the disease.

Stands that are now under good management and are growing vigorously are capable of being attacked.

Mixed stands rather than pure stands seem to offer some resistance to this disease. This may bring about some changes in the planting programs of the different landowners.

Information is not yet available whether or not certain clons of a species of pine may be resistant to attack by *Fomes annosus*.

Deformed roots so often encountered in planting of pine seedlings do not seem to be a factor in the development of the disease.

Birch and Northern red oak are two hardwood species known to be attacked by this fungus in European stands, but there has been no information on this in the United States.

It is believed that this fungus is now in its initial stage and will, perhaps, increase in its severity and research must be continued on methods of controlling this disease of southern pines.

The above discussed forest tree diseases are by no means the only ones for which we have concern. Many of our so called lesser diseases may become our problems of tomorrow as the increase in planting continues.

We must not relax our vigil or interest in forest tree diseases for if we do—we stand to lose.

The information used for this paper was taken primarily from U. S. Forest Service technical publications.

Hardwood Management

John M. McCullough
Department of Conservation

I trust there will be no objection to my broadening of the original subject somewhat from "Bottomland Hardwood Management" to "Hardwood Management." This is done from a technical point rather than from any effort to expand the original intent of the topic.

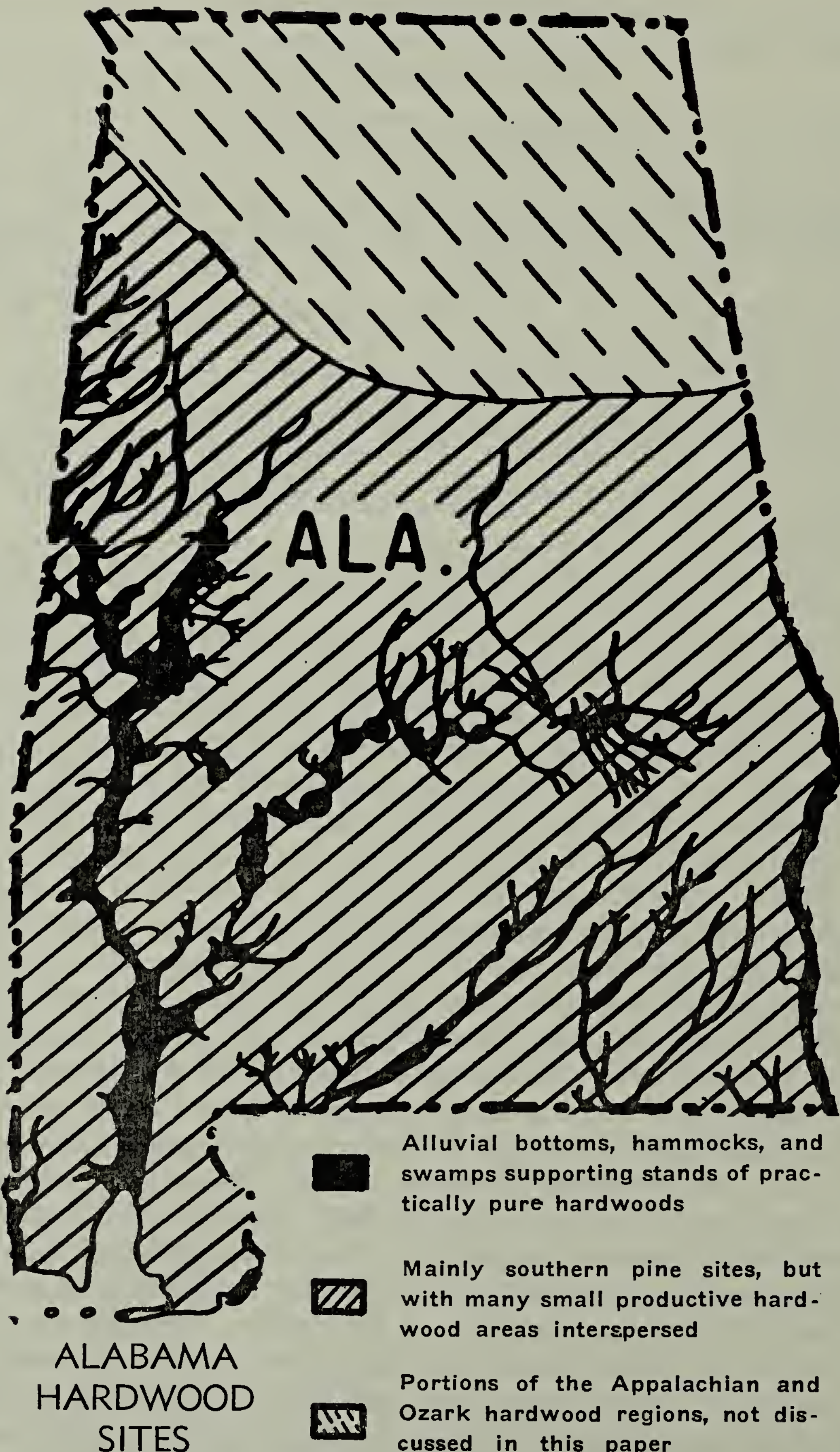
In recent years, and especially since World War II, there has been increased interest in hardwood management. We are all aware of the traditional lack of attention to the proper development of the hardwood resource in the South and, of course, in Alabama.

Several factors have contributed to the new look regarding potentials of our hardwood forests. We recognize the untiring efforts of specialists with the U. S. Forest Service, such as John Putnam and his associates. Our forestry schools in the South have recently placed new emphasis on the need for more instruction on the subject. Several private companies in the hardwood business, some here in our State, have urged for more attention by the technical forester to scientific management of hardwoods.

With this stronger focusing from the leading elements and the general awakening of the profession it may be of interest to consider several aspects of the subject which are not always recognized by those not associated with hardwood work. It is felt that a superficial discussion of a few of these will give a greater appreciation, not only of the task involved in the proper development of our hardwoods but also of the stimulating potentials they possess.

The purpose of this paper is not to delve into the many technical complexities of actual hardwood management. There are two good reasons for this; time would not permit adequate coverage of such; and the speaker is not sufficiently qualified to present expert information on the subject. As stated previously, however, the purpose of this presentation is to help increase our appreciation of this resource and some of the aspects of its development.

At this time, let us identify our subject. A few moments ago I mentioned that the topic was changed to "Hardwood Management." It was felt that the term "bottomland" may place undue restriction on the thinking of the audience regarding the scope of



ALABAMA HARDWOOD SITES

the subject. Even though the large portion of Alabama's hardwood production comes from bottomlands of our major rivers, many of these species grow profitably in creek and branch bottoms which may not be recognized by many as "bottomlands." Furthermore, many of our hardwoods occur in coves and ravines which are not, technically speaking, bottomlands. The hardwood types peculiar to our mountain regions, however, are not included in this discussion. The accompanying chart will give you an idea of the distribution of the hardwood sites in Alabama. As you can see, the heavy black areas along the major streams indicate the alluvial bottoms, hammocks, and swamps supporting stands of practically pure hardwoods, occupying 2.4 million acres or approximately 12 per cent of the State's woodland. The cross-hashed area indicates the regions which are predominantly pine sites but which support numerous small productive hardwood areas interspersed, being largely creek bottoms and branch heads, occupying an estimated 2 million acres or 9 per cent of the State's woodland. This acreage is an estimation of the desirable hardwood sites within the broad southern pine type, and should not be confused with the reported acreage of the upland hardwood type, which covers 3,958.8 million acres in the State.

It should be emphasized that this acreage of desirable hardwood sites is a personal estimation of the extent of those areas of hardwood, within the broad pine type, which should be retained in pure hardwood production. Transition sites or pine sites now occupied by hardwood types are not included. To get the complete picture we should add this estimated 2 million acres of these interspersed hardwood sites to the 2.4 million acres of pure bottomland hardwood sites along our major rivers and arrive at the total of 4.4 million acres, or approximately 21 per cent of the State's forest acreage, as being desirable hardwood sites.

The area above hashed in broken lines shows the Appalachian and Ozark hardwood region which is not included in this discussion.

The importance of Alabama's hardwoods is not difficult to establish. The figures given a moment ago indicate that an estimated 21 per cent of the State's forest acreage is on desirable hardwood sites. These areas include some of the best soils in the State. Even though some are under not even elementary management, these acres have been giving a good account of themselves. The following table shows the production of hardwood lumber compared with pine lumber in Alabama for the period 1946-1959.

Alabama Lumber Production 1946-1959

	Pine	Hardwood	Percent Hardwood
1959	809	458	56
1958	727	410	56
1957	771	419	54
1956	1,077	608	56
1955	1,099	532	48
1954	1,016	571	56
1953	1,064	543	51
1952	1,688	537	31
1951	1,262	681	53
1950	1,433	671	46
1949	1,244	458	37
1948	1,417	675	48
1947	1,396	687	49
1946	1,122	638	57
		Average	49 per cent

(Computed from Alabama Severance Tax receipts, and rounded off to the nearest million bd. ft.)

Without following the production from year to year, let us observe that the average hardwood lumber production for the period was 49 per cent of the State's total pine production.

For fuller recognition of the economic importance of the State's hardwoods, consideration must be given to the numerous railroad ties, mine ties, mine props and other miscellaneous items produced from the hardwood forests.

The history of the public attitude toward our hardwoods may be of interest. It will come as a new thought to some that the hardwood forests of the State have suffered in the same pattern an even worse abuse, perhaps, than our pine, and much earlier in the timber history of the State.

We have long been familiar with the tales of the old stave bolt days. Large prime white oaks were felled and choice sections selected for the distillery trade. These and other specialty products brought about such a demand for our premium species and prime specimens that the worst sort of high grading occurred. This is especially significant in the light of recent and current studies in forest genetics.

The depletion of good parent stock was made more complete

by the common occurrence of wildfire. The usual attitude was that fire did the woods no harm and especially in the swamps. The sad truth, however, was that one bad fire in hardwood stands every twenty years was sufficient to almost completely spoil a crop. Nowdays we know this. We wince at the sight of a gaping hole in the butt of an otherwise beautiful poplar, and think of the untold number of its kin that did not come through as well.

Grazing helped put the finishing touch to the picture of depletion. We have been told that "a cow will walk a mile for a poplar." The open range cow was an energetic critter!

When people ever thought of hardwoods at all, it was with the same attitude exhibited later toward our vanishing pine stands; that of "the good ole days are gone." They were content to reminisce of the grand sized poplar or red oak brought out of the swamps back home, and never dreamed that more money could still come out of those same swamps than ever did at that time.

It is with a fresh feeling of hope that today we are becoming aware of what we have in our hardwood areas. We are grateful for the new attitude and are interested in some of the peculiar aspects of the task of bringing our hardwoods nearer their potential. With this in mind, we should consider some of the following factors:

Basic principles involved in hardwood management are the same as with conifers. Their application, that is finding what you have to work with and secondly, planning definite steps to take, follow the usual pattern. On-the-ground details of hardwood management are often unique, however.

The extreme variability of species is a major item of attention. Identification of the some 70 commercial species found in the hardwood forests presents not only an interesting taxonomic problem, but is absolutely essential to the best management action. As many as 50 species are found on areas of large size. The managing forester must learn to identify these species quickly and accurately, together with developing a knowledge of species—site relations. An example of this need may involve pecan and water hickory, which are often confused, but do not occur on similar sites. Additional confusion among several similar oaks, green and white ash, tupelo and swamp blackgum and blackgum, can be reduced by a knowledge of species as associated with sites.

Site characteristics and variation are usually reflected in species of stands. A thorough knowledge of species-site relation-

ships, however, often helps the forester identify a second-choice stand. That is, a species may occur abundantly, due to improper cutting or other outside influence, on a site which could and should support a more valuable species. Hackberry, for example, is tolerant and will take over a good gum site if the overstory is removed gradually.

Incidentally, another peculiarity of hardwoods is that heavy cutting usually encourages the reestablishment of the better species. When an area is cut it should be cleaned out for a hundred or so feet to admit direct sunlight. This helps us understand the sad deterioration of the stands following the gradual pick and cut system of highgrading in the earlier days.

Site changes can be so subtle at times as to catch foresters inexperienced with hardwoods off guard. Quite often a change in elevation of one foot in the river bottoms can change the site suitability for certain species.

Defects in hardwood stands present another sizeable problem to the manager. To the person unfamiliar with hardwoods many defects caused by diseases or insects will pass unnoticed. The most common diseases are caused by fungi that rot the heartwood. Some of these enter through obvious holes and also cause some degree of swelling which make their presence easily noticed. Others, however, enter more subtly or may produce very little swelling which causes the damage to be missed by the forester that is not alert. A stand may be heavily infected with heart rot which goes unnoticed because the original wound may have grown over in time, and many of the fungi in the South do not form cankers or conks.

Insects do not often kill large areas of hardwoods outright, but do cause enormous losses by lowering the value of the product. Borers and bark scarrers are the chief culprits here. As in the case of the fungi, their damage is often not obvious and requires a skilled eye to be noticed.

The marketing of hardwood is an especially challenging part of hardwood management. The unplanned channeling of all trees into the same product is perhaps one of the most common pitfalls of hardwood handling. Here, I quote a reference: "The primary uses of hardwoods can be broadly classified as (1) veneer logs and bolts, (2) lumber logs, (3) cooperage logs and bolts, (4) small dimension or specialty logs or bolts, (5) piling, (6) posts and props, and (7) cordwood bolts. There is a surplus of trees that will

satisfy requirements of cordwood, posts and props, and construction-lumber logs, and a shortage of trees suitable for veneer bolts or factory-lumber logs. Hence, face-veneer bolts may sell for several hundred dollars per thousand board feet, while the price for structural logs may not cover cost of harvesting, except in the most accessible locations." Taking into consideration that each of the above broad use classes is made up of several different categories of products, and that each category has grades within it, you begin to grasp the importance of the maze of possibilities where the marketing of hardwood is involved. This is not to say that each cutting will include all these products. But, there is a possibility that it will and to know whether or not it does, and to channel each product to its most efficient use is the task of the hardwood manager.

The control of cull trees and undesirable species is quite often one of the first tasks when placing a hardwood stand under management. There are weed species among hardwood stands as well as among pine stands. Quite often the largest, greenest and most desirable looking tree in a hardwood stand is a poor third choice. For example, a healthy but undesirable cedar elm may be overtopping a full stocking of small ash seedlings.

Cull trees must be determined by careful attention to defects. The forester must be able to recognize the possible full extent or limit of damage and avoid eliminating an otherwise healthy and highly merchantable tree on the basis of what might be a localized defect. Timber stand improvement in hardwood stands can be somewhat of a science within itself.

It has not been the intention of this discussion to present the difficult side of hardwood management. The various problems presented do require thorough training and conscientious effort. However, as in any worthy project, the effort put forth pays off in proportion. Therein lies the stimulating aspect of managing hardwoods. After the proper species are encouraged on the proper sites, the stand is improved through the selling or deadening of defective or inferior trees, proper protection given the stand, and the best markets sought for the products, the stand manager can be assured of returns which justify the effort. Hardwood stands will produce. Up to 500 board feet per acre per year plus three quarters of a cord of pulpwood is not an unusual growth in southern hardwoods. Red oaks will outgrow pine on many sites.

Furthermore, fast growth in hardwood makes the wood more desirable, whereas in pine there is an optimum rate.

Wide expanses of hardwood areas have their own particular fascination. Even the logging is different from pine logging, all the way down to techniques in felling. Operational setups are often very interesting. In our own State men still live in floating bunkhouses or barracks, spend weeks in backwaters and bunch and raft logs for river travel. There is a peculiar appeal to the sound of honey bees high in the crowns of a pure tupelo stand. To me such attractions are not mere romantic imaginations but symbolize the real worthiness of this whole business of developing our hardwoods.

Compound Trees

Roland M. Harper
University, Alabama

A typical forest tree, suitable for lumber, has an essentially straight and erect cylindrical trunk, and no branches that one can reach from the ground. But there are many variations from this type in virgin forests, and still more among trees of native species planted in parks or private grounds or along streets.

I am not here dwelling on the well-known fact that many trees which when in their native forests have smooth, clear trunks when mature, when planted for shade or ornament, or coming up spontaneously in fields or pastures, will have numerous wide-spreading branches low down, which may make a pretty shade tree, but are scarcely fit for lumber on account of the many knots.

Many of the cases now described are in and around Tuscaloosa, where I could have seen them more than fifty years ago, if they existed then, and watched them develop their abnormal forms; but I never noticed them until about 1958, and apparently no one else did either.

Some of the simplest cases, in the wild, are small trees, too small for lumber, and some of them hardly more than shrubs, with two or more diverging, and usually more or less crooked, trunks from the same roots. Familiar examples are the gray birch *(Betula populifolia)* of New England and the chinquapin and dwarf sugar maple *(Acer leucoderme)* of the South. In September, 1903, I saw (and photographed) a small black gum swamp in Houston County, Georgia, in which most of the trees were in clumps of three or four, instead of solitary as is usual in that species. Many perennial herbs of course grow similarly.

Still in the forests, there are occasional "freak" cases of two trees of the same species growing a few feet apart and firmly joined together by approximately horizontal limbs. Those naturally attract attention when discovered, as being something unusual, and some of them were written up long ago. The earliest case that has come to my attention was discovered by H. B. Croom in Florida about 1830, and described by him in the *American Journal of Science.* He found two long-leaf pines thus connected, and, more remarkable still, one of the trunks had been severed near the ground in some unknown manner, but was still living, and

supported by the other trunk. Curiously enough, Lieut. George W. Long of the U.S. Artillery discovered the same thing independently soon afterward, and published a note on it in the same magazine about six months later, with a very good illustration. He said the trees were about three miles south of Quincy, and joined about 35 feet from the ground. The severed trunk ended about two feet from the ground, and there was no stump under it, indicating that it had been in that condition quite a while. A few months later in the same magazine Mr. Croom called attention to the fact that he had seen it first, and added that the trees were forty or fifty feet high. (See *Am. Jour. Sci.*, 25:78; 26:106, 28:167-168. 1833-1835.)

Such cases may have occurred in many other places, and been overlooked by people passing under the trees without looking up; but the only other one known to me, in that species, was found near Maplesville, Ala., about fifty years ago. There was near there a "Twin Tree Lumber Co.," and their stationery, if I remember correctly, showed a pair of long-leaf pines joined together in the manner described. By a curious coincidence, when I was on the way to Montgomery for this meeting, my bus stopped a few minutes in Maplesville, and while there I saw two men sitting in front of the bus station who looked as if they might be old enough to remember that lumber company and the twin trees for which it was named. They did, and gave me some additional details.

A similar case of twin beeches in Stockbridge, Mass., was reported, with an illustration, by E. W. B. Canning in the *Popular Science Monthly* (New York) for September, 1887. He said he first noticed it in 1841, and a piece had already been sawed out of one of the trunks, leaving a gap, but it continued to live and grow, even below the junction, for a few years, until some thoughtless person cut the whole thing for firewood. In 1931 I was shown a pair of beeches connected by a stout limb, on the Little Cahaba River near a small colony of summer homes in the eastern part of Jefferson County; and I have been told recently by a man who has a home there that it was still there.

A brief note in *Garden and Forest* (weekly, New York) for Feb. 4, 1891, tells of a pair of elm trees in Lawrence County, Illinois, about twenty feet apart, which had united about twenty feet from the ground into a single trunk, which had reached a height of nearly 100 feet. (This seems almost incredible, and might be

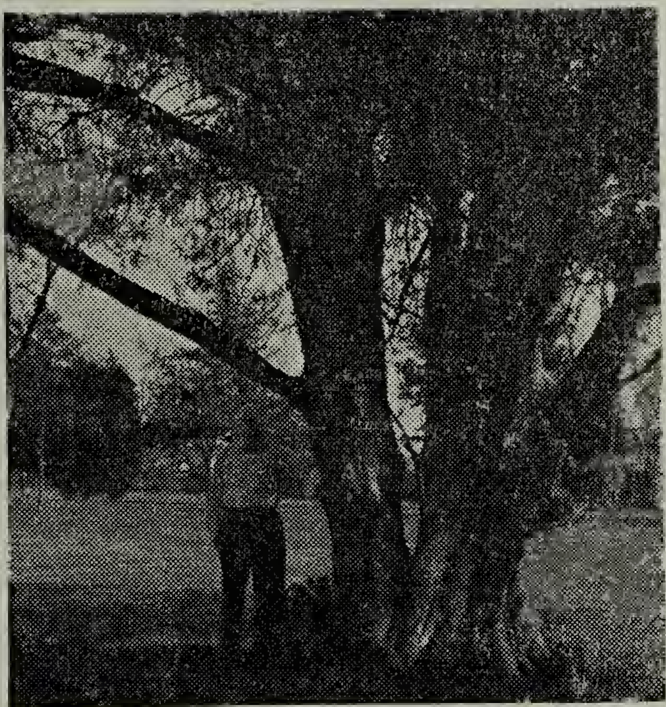


FIGURE 1

Cedar on Bryce Hospital grounds, Tuscaloosa, with trunk divided and fluted. March 10, 1959.

FIGURE 2

Two larger and two smaller trunks of hackberry, on south side of Smith Hall, University campus. (Larger ones about 7 inches in diameter.) March 7, 1959. These have doubtless come from seeds dropped by birds at different times. And if allowed to grow for fifty years or so (which is not likely), they should look something like the compound tree in the next figure.

hard to verify now after seventy years, but might as well be put on record for what it is worth.)

Another kind of compounding is for branches of the same tree to grow together (anastomose), forming loops or windows. That may be commoner in cultivated than in wild trees, but a case of it reported in Brazil by Alfred Russel Wallace over 100 years ago should be mentioned, as he was a distinguished scientist.

He landed at Para (now Belem) in June, 1848, and stayed in South America until 1852, and published a book *Travels on the Amazon* in 1853 (and later editions). On page 17 of the 1889 edition, telling of his first month in Brazil, he said: "Other trees, again, appear as if they were formed by a number of slender stems growing together. They are deeply furrowed and ribbed for their whole height, and in places these furrows reach quite through them like windows in a narrow tower, yet they run up as high as the loftiest trees of the forest, with a straight stem of uniform diameter." He did not specify the species, but there might possibly have been more than one that behaved that way.

In and around Tuscaloosa, if not elsewhere, there are several large hackberry trees along streets and in other open places whose limbs have grown together in various ways, but I have never noticed a case of that in that species in the wild. In the *Greenville* (Ala.) *Advocate* of Dec. 24, 1959, there was a picture of a large yaupon tree *(Ilex vomitoria)* in a yard in that city, with its trunks forming one or more such loops or windows.

I have heard of a few cases, some mentioned in print, and others only by word of mouth, of two trees of different genera, grown in open places, with trunks so close together that they appeared to form a single trunk up to several feet from the ground. That was apparently a spontaneous growth, and not produced artificially by binding the trunks together when comparatively young. It would be very interesting to know if both trees retained their bark and continued to produce annual rings where they were in contact; but that could only be ascertained by cutting the trees, which one does not like to do to a shade tree as long as it is healthy.

Occasionally one will find a tree of a species which is normally a good timber tree, but when grown in a park or some such place will fork near the ground, and again a little higher up, for no apparent reason. One of our well-known timber trees, used perhaps not so much for boards as for articles that require a long straight grain, such as bats and oars, is the white ash, *Fraxinus*

americana. But the illustration of it in the *New International Encyclopedia,* 1914, shows a tree in a park or some such place, forked two or three times, with no intimation that that is not its usual shape. There is a sweet gum (*Liquidambar styraciflua*) of that sort on the University campus, and at the time of this meeting I noticed another usually straight tree, a linden (*Tilia sp.*) on the Huntingdon College campus, with much the same shape.

A reversal of this process can sometimes be seen in the "tree-of-heaven" (*Ailanthus*), a native of China, which used to be commonly grown for shade in the eastern United States, and often escaped to the woods near by, even as far north as New York. It has nothing to recommend it but rapid growth, and when growing along a street or near a dwelling it is usually widely branched and irregularly shaped. But I have found it in low woods near a swamp in Autauga County, growing pretty tall and straight, much like a native forest tree. (See my report on the trees, shrubs and vines of Alabama. Geol. Surv. Ala. Monograph 9. 1928.)

Mr. (later Dr.) John K. Small, in the *Bulletin* of the Torrey Botanical Club for February, 1895, described a few new cases of supposed hybrid oaks. Of one of them, attributed to a cross between *Quercus phellos* and *Q. digitata,* found in considerable numbers in Stanly County, N.C., he said among other things: "Most of the trees noticed had the peculiar habit of forking about three feet from the ground into two erect secondary trunks." And that could hardly have been attributed to the trees having been broken off at that height by tornado or something of the kind, for if it were, many other trees near by should have been affected the same way. It would be very interesting to know if that same condition still exists there, or in other trees of the same parentage elsewhere.

In and around Tuscaloosa, and doubtless elsewhere, there are several trees in open places that fork close to the ground and have two approximately erect trunks. Some of these may have developed two trunks after being cut close to the ground when young, but one would not expect that to happen to a tree planted for shade. However, in the hackberry, which is a sort of weed, and often comes up spontaneously from seeds dropped by birds in places where it was not wanted, I have seen several cases of numerous sprouts from a sapling cut off when it was quite young, and if all were allowed to grow they would ultimately make a very compound tree, which might appear externally to be a single tree with furrowed trunk.

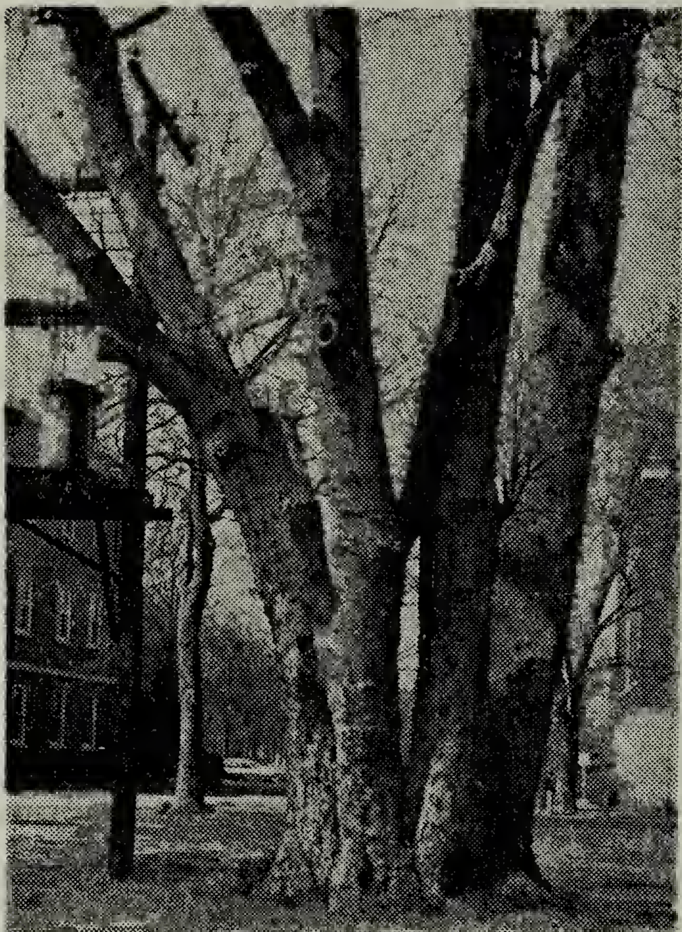


FIGURE 3

Large compound hackberry clump, about 7 feet in diameter, on University campus. March 10, 1959. This is where a fence used to be, and it may have come from three or four seeds dropped by birds around a fence-post.

Although typical forest trees usually have essentially cylindrical trunks, some are naturally inclined to be more or less angled or fluted, as is quite characteristic of the ironwood *(Carpinus)*. And this tendency is more pronounced in some of them when cultivated in the open. A large Mexican cypress *(Taxodium mucronatum)* near the city of Mexico has been an object of attention for some centuries, and several pictures of it have been published, one of them in *Garden and Forest* for March 26, 1890. The pictures show its trunk to be decidedly fluted, and irregular in cross-section; and it could possibly represent several trees grown together. Early in 1960 there appeared in some of our papers a picture of a baobab tree *(Adansonia)* in South Africa, said to be 65 feet in circumference and over 2,000 years old. And its trunk was decidedly fluted, and perhaps compound.

The trunk of the red cedar (*Juniperus*) is usually more or less fluted when growing in the open, and there are two good examples of this on the grounds of Bryce Hospital in Tuscaloosa. In one of them (Fig. 1) the trunk is not only fluted, but divided all the way to the ground. And as it must have been set out originally, it does

not seem likely that it could either have come from two seeds, or have been cut off when very young. (If I had thought to look at it forty or fifty years ago, I would know much more about it now.)

The hackberry (*Celtis mississippiensis*, etc.) as it grows in the forests usually has a reasonably cylindrical trunk, though it may be a little crooked. But it is often planted for shade along streets, and it also springs up from seeds dropped by birds in many places where it is not wanted, such as along fences and in clumps of bushes. In the open its trunk is often, but not always, more or less fluted. One specimen in particular, that I have passed close to nearly every day since it was set out as a sapling a few inches in diameter about 15 years ago, and is now about a foot in diameter, is developing a flat place on the west side and a concave place on the north side. And by the time it is twice as old its trunk may be as fluted as some of the much larger ones along the streets, some of which much resemble the baobab above mentioned.

A photograph taken in a creek bottom in Sumter County in 1913, reproduced in my first report on Alabama forests in the same year, and again in my report on the woody plants of Alabama in 1928, shows what I considered to be a typical hackberry at that time, though not a large one, and it was taken to show that type of forest rather than that particular tree. If the place could be located now and the tree identified, and photographed again, after nearly half a century, it would be very interesting.

At the same time one cannot be quite sure that some of the large hackberries, which one might easily believe now came from a single seed, did not come from two or more seeds planted by birds around a fence-post or something of the kind. The large tree or clump shown in Fig. 3 is certainly located where a fence existed not many years ago. A large one that was cut on the campus about 1958 because it was being killed by fungi had a stump that showed three trunks with bark between. They were about the same size, and one that was still sound enough for the rings to be counted was about 85 years old. The place was once in the yard of a professor's house, and it may well be that birds dropped three seeds around a post about the end of the Civil War, when classes were discontinued for a while, and by the time order was restored the sprouts had gotten so large that they were allowed to continue growing.

There was not much compression of annual rings where the trunks came together, as if the trunks had just pushed apart with-

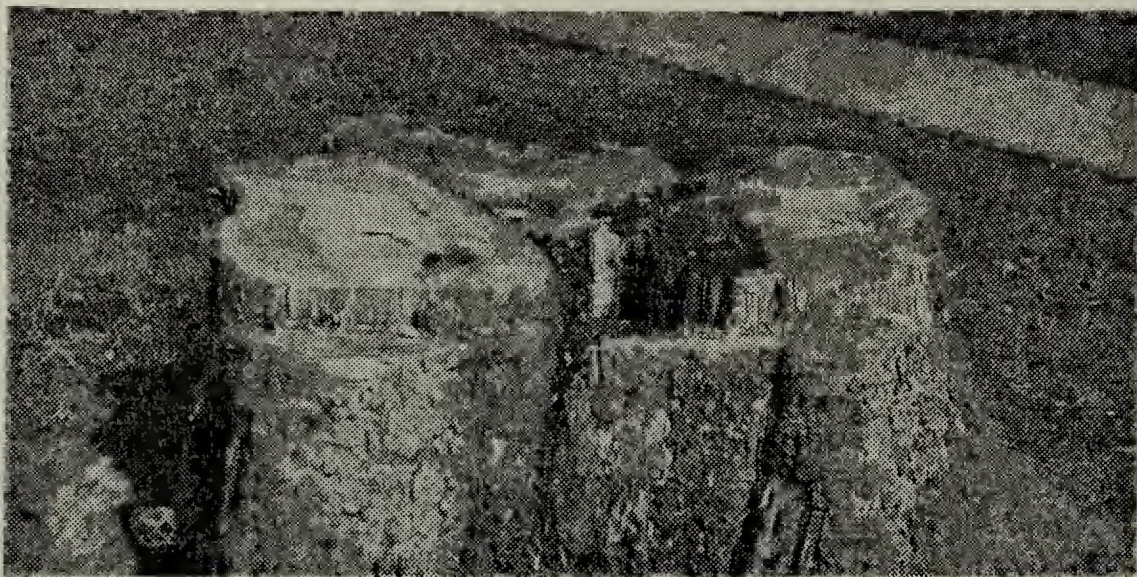


FIGURE 4

Stump of a tripartite hackberry on University campus, cut recently when about 85 years old. March 12, 1959. When living this looked like a single tree, about 4 feet in diameter. But it must have come from three seeds, for the divisions had bark between them. Whether that, or from a tree cut close to the ground when young and sprouting again, the three divisions must have pushed apart, roots and all, as they grew instead of fusing together; and the same must have happened also to No. 3.

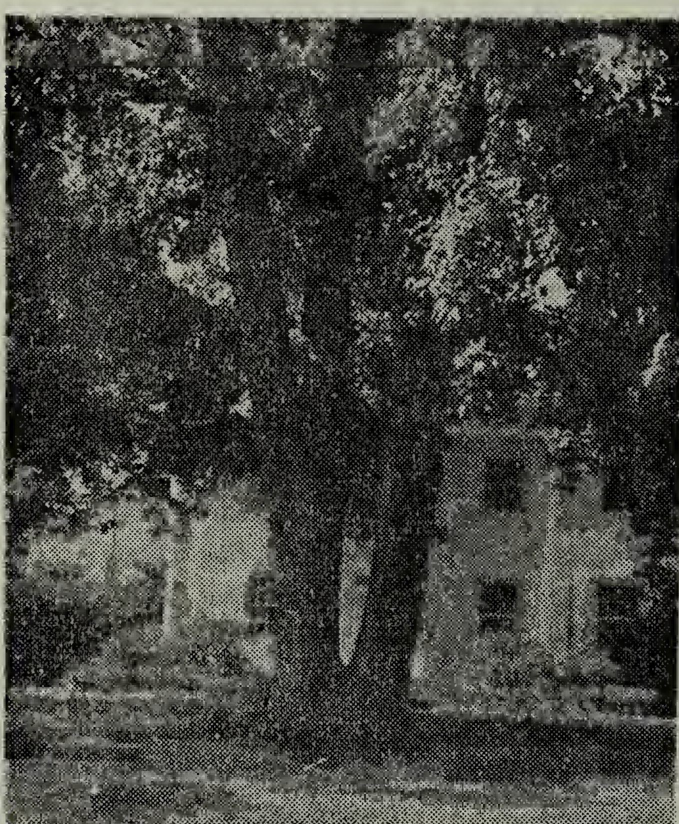


FIGURE 5

Sweet gum in front of a sorority house on University campus, with one crotch about 3 feet from the ground and another about 8 feet. July 28, 1959. The left trunk is about 37 inches in diameter, and the right about 32.

out difficulty as they grew. They might also have been sprouts from the same roots. This might be hard to prove, unless one could watch the same tree, or group, for a good many years.

There is another case on the same campus that might furnish some of the answers if left undisturbed long enough. Close to the wall of one of the buildings there are four hackberry trunks, doubtless from seeds dropped by birds from a ledge several feet above. Two of them, about two feet apart from center to center, are now about eight inches in diameter, and there are two smaller ones in the same row, about two inches in diameter. If allowed to grow for fifty years or so these might resemble a single compound tree; but it is not likely that they will be left so long, for they are not only close to the wall but in front of a window.

If a young botanist who expects to stay at the same institution for many years will locate some of these various kinds of compound trees and watch them for a few decades, and especially when they are cut, he should be able to get an interesting story.

Since this manuscript was sent in I have come across a very important paper on the subject, by Dr. Charles A. White (1826-1910), long known as a geologist, but in his later years connected with the Smithsonian Institution as a sort of independent researcher. In the *Plant World* (Washington) for March, 1903 (Vol. 6, pp. 57-58, pl. 10) he had an article on "Spontaneous fissure of olive trees in Palestine." He found trees there that had apparently split as they grew older into two or more trunks, beginning with shallow fissures between the principal branches, which gradually deepened along the medullary rays, until separate trunks resulted. And the bark grew into the fissures so fast that little or no wood was ever exposed. He said "similar cracks in other trees are known to occur," but did not give examples.

The compound cedar shown in my Fig. 1 might have developed in some such way, for it must surely have had a single trunk when first set out.

Tree Cancers

Roland M. Harper
University, Alabama

A tree when injured by mechanical causes, or insects or fungi, or too much exposure to sun, is likely to develop some abnormal tissues in an effort (so to speak) to repair the damage. The most familiar example is when a piece of bark is knocked or cut off, as in the process of turpentining, formerly common in long-leaf pine forests. In such cases the bark around the cut soon begins to grow inward over the wound (as human skin would), and in time, if not interrupted, the bark will completely cover it, and the process of growing new wood under the bark will continue as before. During the healing process the advancing edge of the bark will normally be smooth and round, even if the normal bark is furrowed or scaly.

Beginning about 1959 I have found on several species of shade trees, in and around Tuscaloosa, many cases of scar tissue and other abnormal growths that I had completely overlooked before (and apparently everybody else had too). I cannot attribute them directly to any external cause, and I am likening them provisionally to cancers in man and animals. Half a century or so ago Dr. Erwin F. Smith, of Washington, a plant pathologist, pointed out an analogy between crown gall (a disease of fruit trees) and cancer, but mine do not seem to be crown galls, and are not on fruit trees. If I could have watched them for several years, I might have seen them start, and traced their development. But I do not know how long I can continue my observations or how long the diseased trees will escape cutting, and I thought I better put on record what I have now, in hope that some one else will continue the study, here or elsewhere.

The most typical form here is two long vertical strips of scar tissue, a foot or so apart, on the trunk of one of the narrow-leaved oaks, as if a long strip of bark between them had been removed, and the scar was gradually healing over.

It is usually on the east, west, or south side of the tree, seldom on the north. Sometimes the wood is exposed all the way between the scar strips, as would be expected if the cause was mechanical, but sometimes bark covers most or all of the space. Ordinarily the scar strips go all the way to the ground, but in one of the photographs shown (with bark intact) they converge and terminate about two feet from the base of the tree.

Usually such trees have one or more dead limbs, but no visible

evidence of fungus infection, and still less of insect or mechanical damage. In the case just mentioned, with intact bark, there are several dark brown woody fungi on the bark between the scar strips, but those seem to be all dead at this time, and the connection between them and some dead limbs several feet higher is not obvious. If one could look under the bark some diseased condition might be found, but one does not like to cut into a shade tree that still has plenty of life in it, especially on a college campus.

In another water oak on the campus it looks as if a large limb on the east side might have broken off about ten feet from the ground, and carried with it a slab of wood about a foot wide and several feet long, which was soon cut near the base to free it from the tree. But the associated scar tissue comes to a point at the top, a little above the broken limb, and at the bottom extends a few feet below where the slab was cut off and the bark is still intact. And the same tree has a few other "cancers" of various sizes, as well as a few dead limbs.

The fact that these "cancers" are seldom found on the north side of a tree suggests sun scald as a possible cause, just as too much exposure to sun sometimes causes cancer on a man's face. But sun scald seems to be more characteristic of fruit and ornamental trees planted south of their natural range, and one would hardly expect them on shade trees within their natural range.

In some cases, instead of two parallel strips of scar tissue, we find a single strip, always vertical, a few inches wide, with a seam in the middle, suggesting that there had once been a wider scar, which is now healed over. But there is such a scar on a "scarlet" oak on the campus, that I have passed nearly every day for 25 years or more, and I am sure it has never been wider than it is now. In fact I doubt if it was there at all ten years ago. That tree has long attracted my attention by its rapid growth, from a few inches in diameter 25 years ago to about two feet now. It looks healthy enough in summer, but in winter one can see that it has a few large dead limbs. If watched for a few years hereafter we should get some very interesting evidence on the subject of tree cancers.

Another form of cancer (if we can call it that) is in shade trees, particularly oaks, with roots exposed so that they are frequently rubbed by human feet. They naturally develop scar tissue there, but that also often extends up the trunk a foot or so, where no feet ever touch, and make a vertical scar with a seam in the middle, like that just described.

So far I have discussed oaks. Somewhat similar scars, but not

quite the same, are often found on hackberry trees (*Celtis*). Some are vertical scars with a seam in the middle, much like that on oak, just described, but a commoner form is inverted V-shape, with the edges several inches apart at the ground, and converging upward into an elongated tip with a seam in the middle. Just how these develop is not known at present, but one of them could be watched for a few years.

Still a different form is found in cedars (*Juniperus*) on and near the campus. A large tree, though apparently healthy, is apt to have the bark missing from the upper sides of approximately horizontal limbs. If it was missing for only a few inches from the trunk, as I noticed in one case, one might suppose that it had been worn off by the feet of boys climbing the tree, for the bark is pretty thin. But the decorticated portion often extends out several feet, where the limb would not support a person. One very slender cedar in a shady place, with very little limb development, has the bark missing from the whole north side, but is still living.

Other cedars in the neighborhood, apparently perfectly healthy otherwise, have some of the wood exposed in spindle-shaped areas a few inches wide on the trunk, around where a small dead limb has broken off. The adjacent bark comes to a thin edge instead of producing scar tissue, as it would in most trees.

Obviously these areas of bare wood on the cedar were once either larger or smaller than they are now. If larger, what caused them, and when did they start to become smaller? If smaller, what caused the bark to recede, without any apparent pathological condition? This too needs to be watched for several years, so that we can tell just what is happening. Or if we could find these things in several different stages we might trace their development without waiting many years for one to run its course, just as we do with successional development of vegetation.

Similar phenomena can be found on other species of trees; and some oaks, hackberry and other trees have various other kinds of abnormal growths, not obviously caused by injury, insects or disease, but I will not go into those at this time.

I have many photographs of supposed tree cancers, but for the sake of economy will use here only two, showing two extreme types, on different species of trees.

Postscript.—Since this paper was presented at the Academy meeting I have come across some references in literature, old and new, that ought to be put on record here.

Dr. Hermann von Schrenk, a well-known dendropathologist, in

the Report of the Missouri Botanical Garden for 1907 (18:77-79, pl. 5, 6), described some "Branch cankers of Rhododendron." He said they occurred on *Rhododendron maximum* throughout the Applachian mountains, and were not caused by fungi or insects, but formed around broken-off branches. His illustrations showed considerable resemblance to one in my illustration of cedar, which formed around a broken-off branchlet.

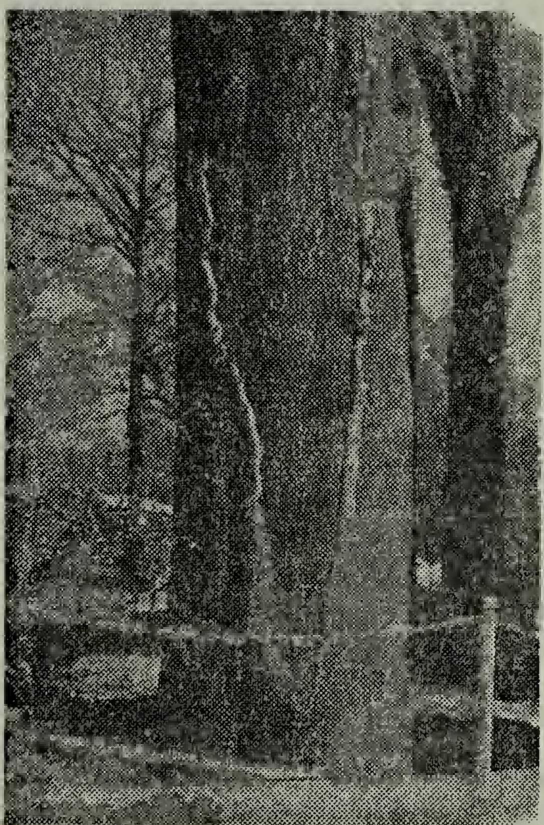


FIGURE 1

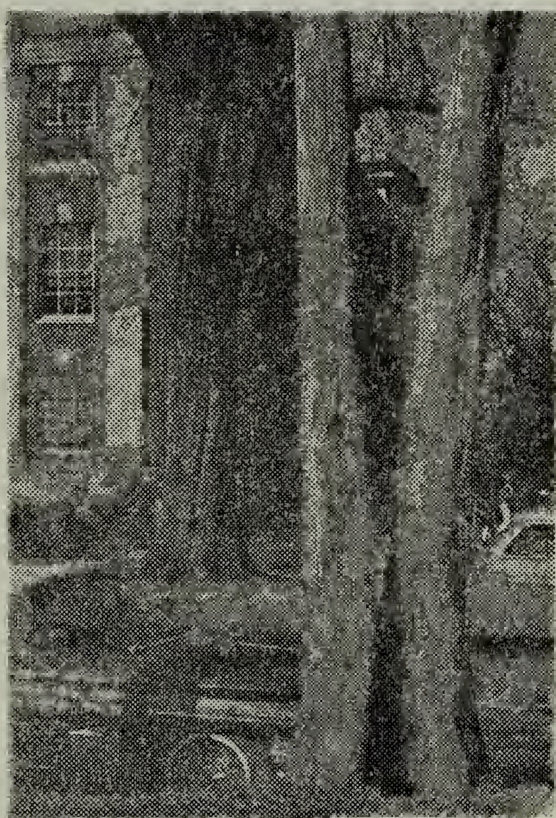


FIGURE 2

Fig. 1, Water oak (*Quercus nigra*) on University campus, with two strands of scar tissue on the west side, about two feet apart at the widest point, and converging about two feet from the ground. The bark between the scars is here intact, but some brown woody fungi (apparently dead) can be dimly seen close to the scar on the right. March 10, 1961.

Fig. 2. Double trunk of cedar (*Juniperus virginiana*) on University campus, with spindle-shaped decorticated place, facing east, around a broken-off branchlet of the one on the left. March 3, 1961.

C. F. Emanuel, in *Science* for May 5, 1961, (133:1420-1422), described and illustrated a "Rare tumor on coast redwood, *Sequoia sempervirens.*" He said it was on a cultivated tree on the University of California campus, and consisted of numerous gall-like excrescences on the branches, always attached on the upper side by a very narrow connective, with no evidence of fungi or bacteria.

In *American Forests* for July, 1962, there is a page of five pictures of various sizes, contributed by Dr. Philip R. White (address not given), entitled "Cancerous trees," with a brief explanation of each. They show tumor-like growths on the trunks of various spruces, some near the Atlantic coast and some near the Pacific. In the October number there is a letter from L. L. Kennedy, of Edmonton, Alta., saying that such trees are common in various parts of Alberta, and are widely used as ornamental gate-posts, etc.

Agricultural Research—A Contribution to Alabama Progress

Lillian Foscue
Auburn University

Alabama was facing some of the darkest days in her history in 1872 when the Agricultural and Mechanical College opened its doors at Auburn. The hand of poverty lay heavily on the land. Loyal Alabamians had been reduced to near starvation in many sections during the days of Reconstruction. It seemed that even Nature had turned her face away from the beaten South as bad crop year followed bad crop year.[1]

With hard times a seemingly permanent guest in the big house as well as in the sharecropper's cabin, farmers clung to the sure money crop of cotton year after year with little or no fertilization to replenish the soil. If cotton was the cash crop, corn was the subsistence crop for man and animal. Few farmers considered soil improvement crops. Cotton and corn were planted year after year on the same ground and yields just as steadily declined. The need for improvement in agricultural practices was a desperate one.

Established as Alabama's Land-Grant College under provisions of the federal Morrill Act, A&M College occupied building and grounds of the East Alabama Male College (EAMC), chartered in 1856. Facing bankruptcy after the Civil War, EAMC trustees offered the facilities of this Methodist college and 20 acres of land to the State to become the A&M College, now known as Auburn University. Purpose of the new institution was to teach subjects "related to agriculture and the mechanic arts. . . in order to promote the liberal and practical education of the industrial classes." Higher education was becoming available for the first time to the "working man."[2]

Earliest administrators of the college recognized the need for practical agricultural experimentation. There was little agricultural literature or few textbooks from which to teach the new college subject of agriculture. However, efforts to set up a system of experimental farms were limited until 1883 when the Alabama Legislature provided funds.

A fertilizer tax was levied, with one-third of the net proceeds to go to A&M College for the establishment and maintenance of an agricultural experimental farm or station "where careful experiments shall be made in scientific agriculture."[3]

Under the terms of the State Act, an experimental farm was established on 226 acres adjacent to the college. J. S. Newman of

the Georgia Agricultural Department was named director of the station and special professor of agriculture.[4]

Experiments were begun immediately and before the year was out the first bulletin was issued—on the care and raising of German carp. Carp was being hailed enthusiastically in Gemany and Austria as a cheap source of protein and even as a "market crop."[5] In the world today fish are promoted as a quick relatively cheap source of food. Farm pond research at Auburn has attracted world attention and Auburn findings have been taken to many countries.

In his introductory statement to the people of Alabama in the same bulletin, Director Newman cautioned them against expecting definite conclusions "in advance" of the most careful investigation.

"The bane of our agriculture has been a disposition on the part of investigators in the field of agricultural experimentation to draw conclusions and announce them as facts before they were definitely ascertained. This will be avoided as far as possible at this station," he promised.[6]

Director Newman further explained that experiments would be of two types: investigations, or those searching for truths not yet established; and illustrative experiments, or those directed to the demonstration of truths already determined but not generally known by all farmers.

Earliest experiments dealt with fertilizers for cotton and corn, variety tests and rotations—all directed toward soil improvement and increased yields. Fruit and vegetable culture was studied in an effort to encourage more diversified farming, but lack of capital forced an extension of the ante-bellum mortgage system with reliance on the cash crop already established—cotton.

A number of experiments in horticulture and animal husbandry too were underway when additional support to agricultural research was gained through the Hatch Act of 1887. This provided $15,000 a year for the Land-Grant College in each state for agricultural research.[7]

As of that date work had been started on classifying and listing native trees and grasses under the direction of Dr. P. H. Mell Jr., botanist and meteorologist, who was to be named second director of the experiment station in 1899. Dr. Mell was in charge of meteorological observations in Alabama for many years, and the system of weather signals originating in Alabama in 1884 was put into national use the following year. Also under Dr. Mell's direction, forestry work in Alabama was begun by collecting and cataloguing sample woods from all parts of the state, with recommendations as to the

best trees for timber and the age at which trees produced best lumber.[8]

Co-operative fertilizer experiments with farmers in different soil localities were started in 1888 and continued with good results until expansion of the experiment station system in 1927. Animal projects were carried on cooperatively after 1911.[9]

Cotton diseases received a major setback as a result of the work of an outstanding biologist, George F. Atkinson. who also started the first entomological work at Auburn. Atkinson distinguished between the effects of fusarium wilt, caused by a fungus which he identified and named, and nematode root gall, caused by minute parasitic worms. He found cotton rust was the result of potash deficiency and consequently fertilizer practices were revised. "Probably more than any other one thing, this discovery improved cotton yields in the South at that time."[10]

J. F. Duggar, who was to take over duties as director of the Auburn Experiment Stattion in 1903, joined the station staff in 1896 as acting agriculturist. Professor Duggar conducted inoculation experiments on crimson clover and other legumes in the mid-1890's and is credited with having been one of the first workers in the United States to have experimented with "artificial cultures." This was an important step in the development of a research program looking toward the conservation and improvement of Alabama's soil resources.[11]

Professor Duggar launched a campaign to help Alabama farmers grow soil-improving legumes. Demonstrations showed that yield of hay from crimson clover, vetch, and alfalfa could be more than doubled by inoculating the seed and that inoculation made it possible to furnish forage where little or none had grown before and improve the land at the same time.

Cotton rotations experiments started in 1896 have come to be known as "The Old Rotation," and are believed to be the oldest continuous cotton experiments in the United States. One of the experiments in the rotation consisted of the test crop, cotton, followed by vetch. During the first 24 years of this basic soil fertility experiment, the vetch frequently failed because little was known about the mineral requirements of legumes.[12]

When the late Dean M. J. Funchess became head of the Department of Agronomy and Soils in 1920, he revised "The Old Rotation" project to provide more phosphate and potash. In 1960 yields produced on plots that had been planted in cotton for 65 consecutive years amounted to 2976 pounds of seed cotton per acre, indicating

that high-yield cotton can be grown year after year on the same land.[13] The cultural practices of leaving the land bare through the winter subject to erosion are partly responsible for the generally low fertility level of many soils on which cotton is grown.

The work with legumes paid additional dividends to Alabama's economy as more farmers have turned toward livestock production, requiring grazing crops.

Improved varieties and species have been developed at the Auburn Experiment Station through the years. In some instances diseases have been met by development of varieties that were resistant to attack. For example, Cook 307 cotton was developed to meet an urgent need for a variety that was resistant to fusarium wilt. Later when a longer staple was required by cotton mills, breeders began in 1936 the task of transforming Cook 307 with its superior wilt resistance into a variety of modern fiber quality. In 1953 Auburn 56 was released to cotton growers.

Efficient feed conversion with a high quality product has been the goal of studies in poultry and livestock as the difference between costs of production and gross sales has continued to narrow.

The economics of farm production received early attention, especially, from Professor Duggar. Cost figures, generally, accompanied his work. When he retired permanently from administrative work in 1921 he began collecting farm management data.[14]

Farm management, as a course, was first taught at the college as part of the Agronomy Department offerings. Agricultural economics became a separate department in 1927. One of the earliest research studies was on the possibilities of egg production on cotton farms on Sand Mountain.[16]

Agricutural engineering got its start at Auburn in much the same way. When the need arose for erosion control practices and the use of farm machinery, courses were taught in the Agronomy Department. The Agricultural Engineering Department was established in 1919 and terracing instruction was begun in each county.[16]

The Agricultural Experiment Station System today consists of the main station at Auburn, 10 substations, five experimnt fields, five forestry units, a plant breeding unit, a foundation seed stocks farm and an ornamental horticulture field station, all strategically located throughout the state. Research projects may be said to range from response of cotton to various nutrients to the association of nutritional problems with cancer.

With the passage of additional legislation and appropriations by the National Congress and the State Legislature, it has been pos-

sible to expand facilities and research programs to meet an ever-growing demand for technical agricultural information.

In the years since the A&M College and experiment station were founded, Alabama agriculture has undergone many drastic changes. Mule and man-power have been replaced by machinery, requiring vast capital investments in initial outlay and upkeep. The 40-acre farm to support a man and his family belongs in the class of "vanishing Americans". Size and efficiency are the key words in commercial farming, and management rather than muscle is the essential ingredient supplied by the farmer.

If research at one time primarily emphasized "helping farmers produce more," today this is too narrow a definition. Consumers as well as farmers are beneficiaries of research. Technological advances in production pass on savings to the consumer. Specific research in agricultural marketing, consumer preference, and food processing is designed for consumer's benefit. The sociological problems of rural populations including employment shifts and leisure time pursuits have created new demands on research in many fields.

Even with the broader aspect of questions confronting agricultural research today, the basic purpose of an experiment station as defined by the first Alabama director remains instrinsically unchanged: "Farmers generally cannot afford either the time or money to conduct experiments with such accuracy and persistency as to render the results valuable. Hence, the necessity for an agricultural experiment station where such investigations are conducted for the general good under the auspices of the state.[17]

Where the emphasis lay in production research in years past, today's agricultural problems demand answers more in economic, marketing, and sociological fields. Where famine is still a problem, distribution seems to hold the solution.

What of the aged or unskilled farmer whose "way of life" is barely subsistence? What is a workable solution for farmers, competing against the market power of industry where giants fix their own prices and finance their own research? If government support of agricultural research and regulation of farm production and prices are inevitable, what are the details of programs and how can they be implemented?

The problems of today's complex society are legion. Results of research completed in the past have helped to solve many important problems confronting Alabama farmers and forest land owners. Tremendous new wealth has been created. But what of tomorrow's needs?

The answers will require the best of facilities and highly trained scientists. The dedication of the men, too numerous to mention, who have accomplished much at Auburn in the past remains unchallenged.

In the words of Auburn's great director of the Experiment Station and first director of Extension, Professor Duggar:

"Shall we go forward only as fast as we have done heretofore, or shall we double the pace . . . The Alabama Experiment Station is at the command of the State for larger service." [18]

LITERATURE CITED

1. Mell, P. H., *Climatology of Alabama,* Bulletin 18, Agricultural Experiment Station of the Agricultural and Mechanical College, Auburn, Alabama, August, 1890, p. 33.
2. Edwards, Charles Wesley, *Auburn Starts a Second Century,* Alabama Polytechnic Institute, Auburn, Alabama, May, 1958, pp. 7-12.
3. Alabama Agricultural and Industrial College Catalogue, 1872, p. 10.
4. First Annual Report of the Agricultural Experiment Station of the Agricultural and Mechanical College of Alabama for 1888, p. 4.
5. Bulletin No. 1 of the State Agricultural Experiment Station, Auburn, Alabama, 1883, p. 6.
6. *Ibid,* p. 4.
7. Annual Report of Agricultural Experiment Station of Agricultural and Mechanical College of Alabama for 1888, p. 4.
8. Mell, P. H., Bulletin No. 1, New Series, Report of Agricultural Experiment Station of Agricultural and Mechanical College, Auburn, Alabama, July, 1888, p. 25.
9. Twenty-fourth Annual Report of the Agricultural Experiment Station of Alabama Polytechnic Institute, Auburn, Alabama, 1912, p. 10.
10. Lyle, James A., *History of Botany and Plant Pathology at Alabama Polytechnic Institute,* Alabama Polytechnic Institute, Auburn, Alabama, p. 501.
11. Smith, E. V., *Advancing Soil and Water Conservation Through Research,* special leaflet, Agricultural Experiment Station of Alabama Polytechnic Institute, Auburn, Alabama, November, 1954.
12. *Ibid.*
13. Personal conversation with D. G. Sturkie, School of Agriculture and the Agricultural Experiment Station of Auburn University, Auburn, Alabama, April 4, 1961.
14. Duggar, Dorothy, *The Life and Agricultural Work of John Frederick Duggar,* Master of Science thesis in history, August, 1951, p. 86.
15. Personal conversation with B. F. Alvord, School of Agriculture and the Agricultural Experiment Station of Auburn University, Auburn, Alabama, April 4, 1961.
16. Nichols, M. L., *History of Agricultural Engineering in Alabama,* "The Alabama Agricultural Engineer," January, 1954, p. 3.
17. Bulletin No. 1, p. 4.
18. Duggar, J. F., Nineteenth Annual Report of the Agricultural Experiment Station of the Alabama Polytechnic Institute, Auburn, Alabama, January 31, 1907, p. 11.

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
AUBURN UNIVERSITY
AUBURN, ALABAMA

VOLUME 33 JULY, 1962 NUMBER 3

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 33 JULY, 1962 NUMBER 3

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

PRESIDENTIAL ADDRESS

A SCIENTIST'S RESPONSIBILITIES IN OUR CIVILIZATION

PAUL C. BAILEY
Alabama College, Montevallo, Alabama

The remarks which I have prepared for this occasion represent nothing new. Everyone interested in the sciences has probably given a good deal of thought to everything that I shall discuss. I strongly believe, however, that the more thought we give to our responsibilities or our obligations to man and the society in which he lives, the more likely we are to do our job well. This is why I have chosen the title, "A Scientist's Responsibilities in Our Civilization," for this address.

In talking about our obligations to man and the society in which he lives, I think that it might be appropriate to look briefly at the past "great" civilizations of the world and compare them to our present "peculiar" age.

The scholarship of the historians and the archaeologists has allowed us to pin to the academic dissecting board a whole series of civilizations about which we are beginning to know a great deal. We know something about the Assyrians and the Egyptians, the Greeks and the Romans, the Aztecs and the Incas, the Chinese, and our own contemporary world. We recognize that all of these civilizations are related in one way or another; but some are more closely related than others. The ones that we know most about are those in direct chronological sequence: Grecian, Roman, Medieval, Renaissance, and Modern. Together these stand as a related family, each inherited something from those which preceded it. Apart from this family, there are a few great civilizations that seem to stand in comparative isolation. Knowledge of these has now been exposed and we are amazed when we study the history of science in China or the complexities of Babylonian mathematics and astronomy. Our own civilization will no doubt stand among those in isolation for we can see that western culture must have somewhere turned in a different direction—a direction which has made science much more productive than in all past civilizations. We cannot help but recognize that we are living in a highly scientific age, one in which the material repercussions of science and technology not only influence our daily lives but also shape the

destiny of Nations as well, and in which to quote Herbert Butterfield "outshines everything since the rise of Christianity and reduces the Renaissance and Reformation to the rank of mere episodes, mere internal displacements, within the system of medieval Christendom."

We know that none of the great civilizations of the past even approached the scientific and technical advances made in our time. This then leads to the consideration of whether ours is a normal civilization or whether we are simply out of step. This is a question which perhaps has no answer, but certainly we realize that for the most part our heritage contains some intruding element, rare and peculiar, which has mushroomed into the activity that now dominates our lives. What is this rare and peculiar element?

Our generation has been privileged to witness some of the greatest scientific and technical advances that man has made during his long history here on earth. The list of these advances would seem endless in almost any area that one could mention. Yes, man is now accomplishing what was considered to be science fiction only a score of years ago. Most of us during our childhood would not have been able to conceive of man orbiting the earth at thousands of miles per hour or of his releasing the tremendous amounts of energy contained within the atom.

With these general statements in mind, I shall now attempt to indicate what I consider to be the most significant contributions which we, as scientists, can make to our civilization. I shall list these and make some comments about each.

(1) Impart the knowledge which we have accumulated during our lifetime to the young people of our generation in such a way that they will be stimulated to pursue with vigorous enthusiasm the truths of our universe.

(2) Make contributions, however small they may be, for the benefit of mankind through basic and applied research.

(3) Teach the layman or non-science person enough science to enable him to understand his environment and the significance of the scientific and technical advances being made.

(4) Maintain a set of moral and spiritual values within our own lives so that we may serve as an example for others.

When we think of the job of stimulating young minds to learn, we realize immediately that man's desire to investigate, and to know, has resulted in an accumulation of knowledge about the natural world in such great quantities that even its storage pro-

duces problems. To put this knowledge into books is but a small part of the answer. To have it available is of no value unless it permeates the minds of men other than those who recorded it. For those of us who are in the teaching profession, the desire to effectively transfer this accumulated knowledge of the past to the next generation, and to help these young men and women learn to use this knowledge and subsequently to expand it, should be as impelling and satisfying as the desire to discover truth itself.

The effective transferring of this accumulated knowledge to a new generation of young minds is complicated by several factors. One of these is that these accumulations are too great for one mind to contain. Therefore, a division and fragmenting of knowledge has resulted, and specialists in these areas have developed. Many of us are victims of this very process. Although specialization seems necessary, we must always remember that the natural world does not operate in compartments or fragments. The more specialized one becomes, the more certain it is that his knowledge will be too limited for him to understand all the problems operating in a particular situation. More than this, the accumulations of knowledge are growing so rapidly that future generations will no doubt find it necessary to become more specialized and will consequently acquire still smaller portions of the total, with less opportunity to attain knowledge in other areas and to comprehend interrelationships. This problem is no doubt prevelant in the social sciences and the humanites as well as the natural sciences.

A second, obvious and related complicating factor is that man cannot live within these compartments of knowledge. He must comprehend the whole in order to master the fragment. With increasing clarity, we are beginning to recognize that knowledge about one or two limited fields is not sufficient. There must be more. How much more is the question facing those of us in the teaching profession. This establishes the idea of minimums in the areas of knowledge other than those chosen for specialization. In other words, how much should one know about the other areas of knowledge in order to be effective in his profession or vocation as well as in his personal, social, and spiritual life?

We are, of course, limited in providing the so-called minimums through our present philosophy towards education — an attitude which demands that we prepare young people to earn a living by the time they are twenty-one to twenty-five years of age. Some people accuse the teaching profession of giving impetus to the

development of this philosophy. Whether we are guilty is a matter of opinion, but it seems that we may constitute a partial solution to the problem. This solution is found in the effective classroom teacher—one who has the ability to stimulate the student or create an interest for his area of knowledge at the introductory college level so intense that the individual student will be eager to pursue learning in this area for the rest of his lifetime. This is a difficult task, but if every classroom teacher could do this, we would no doubt find ourselves living in a more highly advanced and satisfying civilization. What a contribution this would be to our society and to those who must follow!

Our heritage in scientific research in America is an interesting one when we realize that what we call modern basic research is perhaps no more than thirty to thirty-five years old. As someone has suggested, it was little more than a quarter-century ago that we weaned ourselves from Europe as the source of our intellectual sustenance.

The first American to be honored with a Nobel Prize was Michelson in 1907 for his work in physics. Since that time the list has been slow in lengthening, for American science remained indebted to the great minds of Europe. The beginning of America's future greatness in scientific research, however, commenced before the time of Michelson, when young Americans of intellectual promise began studying with the great minds of England, France, and Germany. The generation of Rutherford, Thompson, Roentgen, and others inspired these young minds, and upon their return to America a new and stirring influence was felt. This influence resulted in other pilgrimages to Europe, thus greater numbers were privileged to sit before the greatest scientific minds of the time.

These young Americans were finally able, by the 1930's, to bring to this country the standards of European science—its rigor of thought and its soaring imagination. Thus, during the 1930's, when American industries lay prostrate, science in this country came of age. We have been eye-witnesses to a tremendous growth in scientific research since that time.

Research in America today was recently described as a fat boy, feeding generously upon the billions of dollars supplied by government, industry, research foundations and colleges and universities. The expenditures on research and development in this country during the last twenty years climbed from nine hundred

million dollars to several billions of dollars annually. This expenditure has not been wasted, for it has given us new antibiotics, atomic energy, the ability to orbit our earth, and the many conveniences which we enjoy. Yet, with all our advances in science and technology, scientific research in America, as well as throughout the world, is suffering from malnutrition. This malady has serious implications for the future of our civilization's greatness. It is the relieving of this condition that I should like to propose as one of the scientist's major responsibilities to our civilization. Certainly we must continue with what we are currently doing, but this imbalance must be corrected

Of the billions of dollars spent annually on research in this country, approximately ninety to ninety-five per cent is used to exploit previous scientific breakthroughs. This leaves no more than five to ten per cent for expanding the storehouse of fundamental knowledge which would help us to understand the structure of the universe and the nature of life itself. Many people feel that the influence of science on our society is too great, and that we need a moratorium on research to give the world a chance to catch its breath. This may have appeal, but there will never be a safe plateau on which man can pause even if he wishes to do so. There are too many naked and hungry people in a world which is experiencing an unprecedented population explosion. Certainly there will never be a plateau high enough to satisfy man's aspirations. He is by nature a creature filled with curiosity.

We must keep in mind that the nuclear reactor and the miracle drug do not themselves constitute pure science, but technological end-products of science. The science to be found in these products requires a rambling back through a mystic maze until, behind the designers, engineers, and applied scientists, the fundamental research man appears—the man whose life and work is science—the man who is doing uncommitted thinking or experimenting, prompted by disinterested curiosity and aimed primarily at the extension of the boundaries of human knowledge. I should like to see our generation make this kind of contribution to the civilization in which we live.

A few years ago, as the scientist or the scholar in any area of knowledge emerged from his laboratory or study into the world of laymen, his virtues as well as his frailties became readily apparent. As he began to express his views on moral and political matters, he sounded no better and no worse than the preacher

who pondered about science or the politician who held forth on morality. People were content to take the scientific and technical advances for granted while the scientist concerned himself with little else. With the use of the atomic bomb during World War II, the average person began to be concerned with the consequences of scientific discoveries, while those who made the discoveries became more conscious of the reactions of people and society to these new advances. Since that time we have witnessed increasingly better communication between the two groups.

The scientist recognizes, although the public may not, that there is no ultimate answer to some of the questions he raises. Because the public seeks ultimate answers to the questions raised by science just as it seeks ultimate answers to moral and political questions, some preachers, politicians, and journalists who think in ultimate generalities offer answers that scientists dare not give. Some scientists, on the other hand, irritated or inspired by the intrusion of "outsiders" into their field proceed to lay down ultimate moral and political principles themselves. This is good! The point is not that we stand in need of the scientist's views on politics, the politician's on morals, or the churchman's on science. The point is that we are beginning to knock down some of the barriers behind which too many of our specialists have been operating.

Let us not stand idly by with the key to modern civilization and to future progress in our formulas and instruments. We must alert the public to the necessity of providing our young people with an education which will prepare them for life in an age of science and technology. Let us not remain passive. The creative imagination of the scientists who gave us the principles of genetics and evolution, the law of gravity, and the periodic table must be ranked with the inspired contributions of Shakespeare and Beethoven to our culture.

Now that the general public is beginning to realize the role of science in our civilization, and that we are in a continual process of change—one which threatens us with almost uncontrollable deluges and eruptions—let us not lose our faith in mankind and more important in a supreme power. I am afraid that the scientist, or the scholar in any other area, is too often labeled by the lay person as an individual who has no belief in God. I am convinced that the **great scientist** is one who has this belief and is dependent upon his faith in God for strength and courage and wisdom.

OFFICERS OF THE ALABAMA ACADEMY OF SCIENCE 1962-1963

PROGRAM

THIRTY-NINTH

ANNUAL MEETING

of the

Alabama Academy

of

Science

With The

GORGAS SCHOLARSHIP FOUNDATION

And The

ALABAMA JUNIOR ACADEMY OF SCIENCE

APRIL 20-21, 1962

TROY STATE COLLEGE

Troy, Alabama

ALABAMA ACADEMY OF SCIENCE

Thursday, April 19

6:30 P.M.—Dutch dinner for members of the Executive Committee .... Grimes Cafe

8:00 P.M.—Executive Committee, open meeting .... Room 110, McCall Hall

Friday, April 20

8:00 A.M.—Registration .... Lobby, McCall Hall

9:30 A.M.—General Session .... Auditorium, Room 110, McCall Hall

10:00 A.M.—Section Meetings

- I. Biological Sciences .... Room 205, McCall Hall
- III. Geology and Anthropology .... Field Trip (Leave from Bibb Graves Hall)
- VIII. Social Sciences .... Room 111, McCall Hall
- IX. Medical Sciences .... Room 203, McCall Hall
- X. Engineering .... Room 210, McCall Hall

12:00 Noon—Lunch .... Cafeteria, Smith Hall

1:30 P.M.—Business Session .... Auditorium, Room 110, McCall Hall

2:00 P.M.—Section Meetings

- I. Biological Sciences .... Room 205, McCall Hall
- II. Chemistry .... Room 203, McCall Hall (Joint meeting with Section IX, Medical Sciences)
- III. Geology and Anthropology
  - Geology .... Room 206, McCall Hall
  - Anthropology .... Room 209, McCall Hall
- IV. Forestry, Geography and Conservation .... Room 200, McCall Hall
- V. Physics and Mathematics .... Room 208, McCall Hall
- VIII. Social Sciences .... Room 111, McCall Hall
- IX. Medical Sciences .... Room 203, McCall Hall (Joint meeting with Section II)
- X. Engineering .... Room 210, McCall Hall

4:00-5:30 P.M.—Junior Academy of Science Exhibits open to Academy members and the public .... Third Floor, McCall Hall

7:30 P.M.—Banquet, Alabama Academy of Science .... Ingram's Restaurant

Presidential Address: "A Scientist's Responsibilities In Our Civilization."

Host: E. H. SARGENT AND COMPANY

9:00 P.M.—Informal smoker, Faculty Lounge, Smith Hall

Saturday, April 21

8:00-
12:00 Noon—Exhibits of Alabama Junior Academy of Science open to Academy members .... Third Floor, McCall Hall

8:00 A.M.—Section Meetings

I. Biological Sciences .... Room 205, McCall Hall
III. Geology and Anthropology .... Room 206, McCall Hall
VII. Science Education .... Room 113, McCall Hall
VIII. Social Sciences .... Room 111, McCall Hall
X. Engineering .... Room 210, McCall Hall

10:00 A.M.—General Session with Alabama Junior Academy of Science .... Smith Auditorium

—Presentation of A.J.A.S. Officers and Counselors
—Presentation of A.A.A.S. Awards
—Presentation of Award to Outstanding A.J.A.S. Region
—Presentation of Undergraduate and Graduate Research Awards
—Introduction of A.A.S. Officers—1962-63
—Address: Mr. R. Vance Miles, Jr., Vice-President, Gulf States Paper Corporation, and Chairman, Board of Trustees, Alabama Academy of Science. Topic: "Dreams, Plans and Deeds—The Science Teams of the Future."

12:00 Noon—Adjourn

Gorgas Scholarship Foundation

Thursday, April 19

(Selection of winners of Alabama State Science Talent Search for General Gorgas Scholarships)

5:00 P.M.—Demonstration of exhibits to judges—Physics Lab, 303 McCall Hall

6:30 P.M.—Banquet for Gorgas finalists, judges and guests — Ingram's Restaurant

8:00 P.M.—Personal interviews of finalists by judges—Second Floor, McCall Hall

Alabama Junior Academy of Science

Friday, April 20

8:00 A.M.—Registration .... South Entrance McCall Hall

8:00 A.M.—Preparation of Exhibits .... Third Floor, McCall Hall

10:00 A.M.—Caucus of officers and official delegates .... 110 McCall Hall

10:00 A.M.—Conference of sponsors and counselors .... 110 McCall Hall

10:45 A.M.—Business Meeting .... 110 McCall Hall

12:00 Noon—Lunch available for AJAS members and sponsors at Student Center

12:00 Noon—Luncheon for AJAS Executive Committee — Little Auditorium, Student Center

12:30 P.M.—Executive Committee Meeting .... Little Auditorium, Student Center

2:00 P.M.—Section Meetings of the Alabama Academy of Science *(Junior Academy members are encouraged to attend one of these meetings.)*

3:00 P.M.—Judging of exhibits .... Third Floor, McCall Hall

7:00 P.M.—Annual banquet for Alabama Junior Academy of Science .... Student Center

Saturday, April 21

8:00 A.M.-12:00 Noon—Exhibits on display .... Third Floor, McCall Hall

8:00 A.M.—General Assembly—Presentation of scientific papers by Regional Finalists .... 110 McCall Hall

9:00 A.M.—Business Meeting .... 110 McCall Hall

10:30 A.M.—Joint meeting of Alabama Academy of Science and Alabama Junior Academy of Science .... Smith Auditorium

12:00 Noon—"Dutch Treat Luncheon" for Old and New Executive Committee Members .... Student Center Cafeteria

Section Programs

10:00 a.m., Friday, April 20

SECTION I, BIOLOGICAL SCIENCES

Herbert T. Boschung, Jr., Vice-President

1. **Sensitivity of Euglena Gracilis Klebs to Ultra-Violet Radiation Following Temperature Treatment.**
   Margaret Waldrep, University of Alabama.
2. **Preliminary Studies on the Effects of Isocaloric Synthetic Diets on Mouse Tumors.**
   J. Richard Thomson, Southern Research Institute.

3. **Growth Distribution and Yield of Some Common Bermuda-grass Ecotypes Collected in Alabama.**
C. S. Hoveland, Auburn University.
4. **Non-Crustose Lichens of the Howard College Natural Area.**
Herbert A. McCullough, Howard College.
5. **Fishes of the River Styx.**
A. F. Hemphill, Spring Hill College.
6. **Relation of Pecan Scab Control to Nut Quality in Alabama in 1961.**
Urban L. Diener, Auburn University.
7. **Gymnema Sylvestre and Taste Studies.**
Kamal S. Yackzan, Alabama College.
8. **Stem and Root Necrosis of Coastal Bermuda Grass Caused by Helminthosporium Spiciferum (Bain.) Nicot.**
Robert T. Gudauskas, Auburn University.

SECTION III, GEOLOGY AND ANTHROPOLOGY

(Field trip to selected brown iron ore deposits, Pike County, Alabama.)
Field leaders: Earl L. Hastings, William E. Smith, Dossey H. White, Jr.
Guidebook: 10 pages, free.
Depart: 8:00 A.M., April 20, 1962, front entrance to Bibb Graves Hall.
Return: 1:00 P.M., April 20, 1962, front entrance to Bibb Graves Hall.
Transportation: Private conveyance.

SECTION VIII, SOCIAL SCIENCES

James F. Doster, Vice-President

1. **The Use of Science in the Social Sciences.**
Leonard Y. Trapp, Troy State College.
2. **Some Reflections on American Capitalism.**
E. D. Chastain, Jr., Auburn University.
3. **The Financial Institutions Excise Tax in Alabama.**
Arnold L. Barrett, University of Alabama.
4. **Further Discussion of a Behavioral Model for Ontogeny.**
Eleazor C. Overton, O.D., and Glen W. Herren, O.D., Practicing Optometrists, Birmingham.
5. **Max Weber, A Socrates for the Social Sciences.**
Richard M. Owsley, Auburn University.

SECTION IX, MEDICAL SCIENCES

William J. Wingo, Vice-President

1. **Techniques in Electrophysiological Studies of Taste.**
Kamal S. Yackzan, Alabama College.
2. **Effects of Ionized Air on Pathological Bacteria.**
Hoyt A. Childs, Jr., Samson High School.
3. **Robert Archibald Lamber.**
Emmett B. Carmichael, University of Alabama Medical Center.
4. **Synergism of Human Sera and Antiviral Agents in Vitro.**
Gussie Arnett and G. J. Dixon, Southern Research Institute.
5. **Development in Vitro of a Strain of Poliovirus Resistant to Guanidine.**
Sara M. Sellers and G. J. Dixon, Southern Research Institute.

†6. **The Development of the Axial Muscles in the Cervical Region of the Rabbit.**
Raymond F. Gasser, University of Alabama Medical Center.

7. **Daniel Drake—A Pioneer Teacher—Physician.**
Emmett B. Carmichael, University of Alabama Medical Center.

2:00 p.m., Friday, April 20

SECTION I, BIOLOGICAL SCIENCES

Herbert Boschung, Jr., Vice-President

1. **Age-Size Correlation of Over-Story Trees in Two Longleaf Pine Forests.**
C. M. Farmer, Troy State College.
2. **Anabolic Steroids and Avian Growth.**
J. R. Howes, Auburn University.
3. **The Composition and Production of Avian Dust.**
J. Koon, W. Grub, and J. R. Howes, Auburn University.
4. **Microsporogenesis in Hypericum patulum Thunb.**
5. **Effects of Radiation on the Photoperiodism of Portulaca smallii.**
David J. Cotter, Alabama College.
6. **Influence of Calcium and Strontium Upon Growth and Development of Two Aquatic Phycomycetes.**
Patricia M. Meller and Joseph C. O'Kelley, University of Alabama.
7. **Reproduction and Species Survival in Croton Alabamensis, a Shrub Endemic to Alabama.**
Joe A. Farmer, University of Alabama.

8. **Inhibition of Growth of Sensitive and 6-Mercapto-purine-resistant Mammalian Cells by 9-Alkylpurine.**
Doris J. Adamson, G. G. Kelley, Ellen P. Horton, and Margaret H. Vail, Southern Research Institute.

†9. **The Construction and Application of a Simple and Economical Electrocardiograph.**
J. K. Pruett, Auburn University.

SECTION II, CHEMISTRY

Paul Melius, Vice-President

1. **The Determination of R_2O_3 by Homogeneous Precipitation.**
Frederick W. Williams and James L. Kassner, School of Chemistry, University of Alabama.

2. **The Isomeric Forms of the Niobium(V)-oxy-tricupferron Complex.**
Jose Sanchez-Caldus and James E. Land, School of Chemistry, Auburn University.

3. **Investigations of Phenylenethiazole Polymers for Heat Resistant Fibers.**
Thomas B. Cole, Southern Research Institute.

4. **Comparative Studies of Sensitivity of Sarcoma 180 Adenocarcinoma 755 in Cell Culture to Certain Anticancer Agents.**
Elizabeth Ann Dulmadge and G. J. Dixon, Southern Research Institute.

5. **Effect of Cholic Acid Derivatives on Pancreatic Lipase.**
Paul J. Fritz and Paul Melius, School of Chemistry, Auburn University.

6. **Studies on the Activity of Some Antiviral Drugs Utilizing the Agar Plate Assay Technique.**
Charlotte M. Maxwell and G. J. Dixon, Southern Research Institute.

†7. **Aspects of Structure and Auxin Activity Studies of Indole-3-Acetic Acids.**
Karl Wiegand, School of Chemistry, Auburn University.

8. **The Identification of Galactose and Lactose in Urine by Electrophoresis.**
Walter H. Johnson, University of Alabama Medical Center.

SECTION III, GEOLOGY AND ANTHROPOLOGY
(Anthropology Session)

A. T. Hansen, Acting Chairman

1. **Early Archaic Burials in the Stanfield-Worley Shelter.**
   David L. DeJarnette, University of Alabama.
2. **A Pre-ceramic Site in the Chattahoochee Basin.**
   Oscar W. Brock, University of Alabama.
3. **A Progress Report on Salvage Archeology in the Walter F. George Basin.**
   Edward B. Kurjack, University of Alabama.

*4. **Historic Sites of North Alabama.**
   Jewel C. Green, University of Alabama.

5. **The Hickory Bend Site, 1 Mt 100 (Montgomery County, Alabama).**
   John W. Cottier, Auburn University.
6. **A Historic Site in the Logan Martin Reservoir.**
   L. Ross Morrell, University of Alabama.
7. **A Proto-historic Site in South Central Alabama.**
   Tandy K. Bozeman and Wilbur A. Cockrell, University of Alabama.
8. **Contributions in Anthropology at the Tenth Pacific Science Congress.**
   Paul H. Nesbitt, Research Studies Institute, Air University.

SECTION III, GEOLOGY AND ANTHROPOLOGY
(Geology Session)

T. W. Daniel, Jr., Vice-President

†1. **The Post-Ripley Lacuma in Alabama.**
   George F. Brockman, IV, University of Alabama.

†2. **The Development of Small Stacked Harmonic Folds in Thinly Layered Rocks.**
   William D. Maples, University of Alabama.

3. **Geology and Ground-Water Resources of Bullock County, Alabama.**
   John C. Scott, U.S. Geological Survey.
4. **Road Building Material of the Birmingham Area.**
   John W. Jones, Alabama Highway Department.
5. **The Potentialities of Kyanite in Alabama.**
   Thomas A. Simpson, Geological Survey of Alabama.

6. **Salt in Alabama.**
   Thomas J. Joiner, Geological Survey-Oil and Gas Board of Alabama.
7. **Some Observations on the Low Flow of Streams as Related to Geology.**
   C. F. Hains and L. B. Pierce.
8. **Should Geologists Become Registered as Professionals?**
   Jack E. Morris, U.S. Pipe and Foundry Company.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

John M. McCullough, Vice-President

1. **Fire Danger Measurement and Its Application in Forest Fire Control.**
   C. F. Attaway, Department of Conservation.
2. **Droughts in Alabama.**
   Arthur R. Long, U.S. Weather Bureau.

*3. **An Analysis of the Legislative Efforts of the Federal Congress in Behalf of Forests and Forest Lands, 1950-1955.**
   Robert James, Auburn University.

4. **Sumter County, Leader in Alabama's Beef Economy.**
   Hazel Stickney, Livingston State College.

*5. **An Analysis of the Legislative efforts of the Federal Congress in Behalf of Forests and Forest Lands, 1955-60.**
   Richard Mills, Auburn University.

6. **Relationship of Topography and Soil to Yellow-Poplar Total Height.**
   Glendon W. Smalley, Birmingham Branch, Southern Forest Experiment Station.
7. **Preliminary Report on the Effects of Chemical Sprays on the Fishery and Wildlife Relative to the Experimental Control of the Forest Tent Caterpillar (Malacosoma disstria Hbn.) in Clarke and Baldwin Counties, Alabama.**
   Luther G. McBay and Ralph H. Allen, Jr., Alabama Department of Conservation.

SECTION V, PHYSICS AND MATHEMATICS

Howard Carr, Vice-President

1. **The Design, Theory, and Experimental Application of a Proportional Counter.**
   Chris Patte, University of Alabama.

2. **A Comparison of High School and College Mathematics Grades.**
W. L. Furman, S.J., Spring Hill College.
3. **Hysteresis Experiments in Intermediate Electricity and Magnetism Laboratory.**
Thomas I. Hicks, Howard College.
4. **Apparatus For Observing the Mossbauer Effect.**
K. F. Suen, Auburn University.
5. **Use of Thick Photographic Emulsion In Nuclear Films.**
Gary Marmer, Auburn University.
†6. **Further X-Ray Studies of Eggshell Crystal Structure.**
Charles J. Cain, Auburn University.
7. **Sub-Millimeter Radiation From A Relativistic Electron Beam.**
W. H. Venable, University of Alabama.
8. **Use of Hatree Wave Functions For Cesium in Determining Theoretical Cross-Section For Electron Scattering.**
W. Ray Garrett, University of Alabama.
9. **Theoretical Treatment of Atomic Scattering of Electrons From Cesium.**
Karl R. Klose, University of Alabama.

SECTION VIII, SOCIAL SCIENCES

Chester W. Hartwig, Vice-Chairman

1. **The Effect of Annexation Upon Centralization and Suburbanization in The Metropolitan Centers of Alabama, 1950 to 1960.**
Henry L. Andrews, University of Alabama.
2. **Factors Affecting the Solution of Community Problems.**
John H. Carr, Birmingham.
3. **The Psychology of Reading.**
Frederick L. Westover, University of Alabama.
4. **Social and Economic Changes in Sumter County during the 20th Century.**
B. B. Williamson, Jr., Auburn University.
5. **The Central American Mission in Central America.**
Wilkins B. Winn, University of Alabama.
6. **Some Montgomery Housing Statistics.**
Roland M. Harper, Alabama Geological Survey.

SECTION IX, MEDICAL SCIENCES

William J. Wingo, Vice-President

(Joint Meeting with Section II—Chemistry)

8:00 a.m., Saturday, April 21

SECTION I, BIOLOGICAL SCIENCES

Herbert Boschung, Jr., Vice-President

1. **Incidence and Control of Peanut Leafspot.**
   James A. Lyle, Auburn University.
2. **A Botanical Bonanza in the Black Belt.**
   Roland M. Harper, Geological Survey of Alabama.
3. **Effects of Hydraulic Pressure on Soil and Plant Nematodes.**
   Eldon J. Cairns, Auburn University.
4. **Plant-growth Regulators in Agar Media for Isolation of Soil Fungi.**
   Elroy A. Curl, Auburn University.
5. **Reptile Mimics from Costa Rica.**
   Roy E. Smith, University of Alabama.
6. **Oyster Mortality in Mobile Bay.**
   Jack C. Mallory, University of Alabama.
7. **Serotonin and Gastric Motility: A Preliminary Report.**
   Kenneth Ottis, Auburn University.

SECTION III, GEOLOGY AND ANTHROPOLOGY

T. W. Daniel, Jr., Vice-President

1. **Radiation Surveying for Petroleum.**
   William B. Collins, Geological Survey-Oil and Gas Board of Alabama.
2. **Origin and Occurrence of Some Alabama Clays.**
   Otis M. Clarke, Jr., Geological Survey of Alabama.
3. **A Challenge to Geologists of the Future.**
   Philip E. LaMoreaux, Geological Survey of Alabama.
4. **The Utley Coal Bed in the Western Warrior Field.**
   Reynold Q. Shotts, University of Alabama.
5. **Geology in Highway Engineering.**
   Robert D. Palmore, Alabama State Highway Department.

6. **Petrology of Some Lower Mississippian Carbonate Rocks of North Alabama.**
   William E. Smith, Geological Survey of Alabama.

7. **Some Persistent Sandstones of the Western Warrior Field.**
   Reynold Q. Shotts, University of Alabama.

8. **Strippable Coal in the Fabius Area, Jackson County, Alabama.**
   Thomas W. Daniel, Jr., Geological Survey of Alabama.

9. **A Review of the Eocene Archaeocetes of Alabama.**
   Douglas E. Jones, University of Alabama.

SECTION VIII, SOCIAL SCIENCES

James F. Doster, Vice-President

1. **The T.V.A. Bill of 1933: Differing Views of Montgomery and Nashville Newspapers.**
   B. R. Coleman, Troy State College.

2. **An Oligopoly in Action.**
   H. Ellsworth Steele, Auburn University.

3. **Spanish Maps: A Tool for the Study of our Colonial History.**
   Alfred B. Thomas, University of Alabama.

4. **The Problem of Labor in the Post-Bellum South.**
   Milton M. McPherson, Alabama College.

5. **Some Alabama Criticisms of the Second New Deal: 1935-1939.**
   George V. Irons, Howard College.

6. **Rural Resource Development.**
   Ralph L. Sherer, Auburn University.

* *Entry for undergraduate student research award.*

† *Entry for graduate student research award.*

FALL EXECUTIVE COMMITTEE MEETING

Howard College, Birmingham

November 18, 1961

The meeting was called to order at 9:15 a.m. The following were present: Paul C. Bailey, presiding, William J. Barrett, Reuben B. Boozer, Herbert Boschung, D. F. Butler, T. W. Daniel, Jr., W. B. DeVall, Louis J. Eisele, S.J., John A. Fincher, Robert H. Garner, James R. Goetz, Clarence C. Hall, Jr., Roscoe D. Kelley, John M. McCullough, Mrs. Carol Ann Padgett, Reynold Q. Shotts, G. O. Spencer, J. Richard Thomson, George O. Twellmeyer, S.J., Ruric C. Wheeler, Carlton Whitt, H. E. Wilcox, William T. Wilks.

The Secretary read the minutes of the April 6, 1961, Executive Committee Meeting and the minutes of the April 7, 1961, Annual Business Meeting exclusive of committee reports. Correction was made in the minutes of the April 7, 1961, Annual Business Meeting as follows: "On page 15, opposite 'Balance December 31, 1960,' the sum '\$6809.08' was changed to '\$2749.67,' upon recommendation of Barrett." President Bailey declared the minutes approved as corrected.

Report of the President (Bailey).

R. Vance Miles, Jr., has been appointed as Chairman of the Board of Trustees. All committee chairmen have also been appointed. Other matters normally included in a report of the President are to be considered on the regular agenda.

Report of the President-Elect and Chairman of Membership Committee (Eisele).

The Chairman of the Committee on Membership announces that he has delayed making an effort to increase the membership of the Academy pending the decisions of the Executive Committee concerning a change of title of Section VI, Article III of the Academy By-Laws. The Chairman feels that a fairly large membership potential exists among the Engineers of the State. Section VI, Industry and Economics, is at present unappealing to this group because of lack of emphasis on Engineering Science.

98. Motion by Goetz, seconded by Fincher that President-Elect's report be accepted. Motion passed unanimously.

Report of the Chairman of Board of Trustees (read by Secretary DeVall).

I am deeply honored to serve the Academy, and my belief in its excellent work and accomplishment continues to grow more profound each

year. I would like to extend my gratitude to President Bailey and to the members of the Executive Committee for the privilege of serving as Chairman and member of the Board.

Needless to say, I have read with high interest the minutes of the Spring Meeting and find myself in total agreement with the motions and resolutions deliberated and passed. All seem to be sound and worthy of our support and should be regarded as actions to firm the foundations on which to continue building an increasingly effective Academy. Certainly the activities of the Junior Academy deserve the applause of all who are familiar with its development and undertakings.

The Academy editors are doing a splendid job in the format and printing of the *Journal* and the *Newsletter*. The increase in annual dues is certainly a step in the right direction and should provide better financing for the essential Academy operations.

The Academy is truly the hub around which the wheel of research, development and application of science should revolve. We members could each do much more to make this thought a magnificent reality. May I beg you to accept the challenge to lead the way so that the full potential of the Academy and its distinguished members can best be used to remove the shadows of the future.

99. Motion by Wilks, seconded by Twellmeyer that the report of the Chairman of the Board of Trustees be accepted. Motion passed unanimously.

Report of the Secretary (DeVall).

All duties of the Secretary have been discharged. Section Vice-Chairmen were notified of their duties. Some confusion arose in connection with the forthcoming change in dues. All concerned were notified that the new members paying $3.00 would be paid up through December 31, 1961 and entitled to 1961 publications of the Academy. Those who choose to make their membership effective in 1962 would pay $5.00.

The membership list has been brought up to date. Some errors in Honorary Memberships were discovered. Assistance from the Executive Committee would be appreciated in verifying the status of the following 11 names, and others.

Allison, Fred J. (PM)
Carmichael, Emmett B. (MS)
Farmer, C. M. (BS)
Gardner, Wright A.
Harper, Roland M. (GA)
Jones, E. V. (C)
Jones, Walter B. (GA)
Jennings, Henry L. (IE)
Kassner, J. L. (C)
McGlamery, Miss Winnie (GA)
Yancey, Patrick H. (BS)

100. Motion by Shotts, seconded by Boozer that the report of the Secretary be accepted and that the eleven honorary members be continued on the Secretary's records. Motion passed unanimously.

Report of the Treasurer (Barrett).

BALANCE, January 1, 1961			$2755.67
RECEIPTS			
Membership Dues		$ 710.00	
Gifts		60.00	
Research Grant from AAAS		200.00	
Sale of Journals		2.00	
Annual Meeting		996.50	
Interest on Savings Account		23.24	
Return of Research Grant		150.00	
		$2141.74	$2141.74
		TOTAL	$4897.41
EXPENDITURES			
Publication of Journal		472.50	
Assistance to AJAS		349.88	
Student Research Awards		15.00	
Research Grants		450.00	
Academy Conference Assessment		11.68	
Annual Meeting		1522.31	
Operating Expense:			
President	$ 90.61		
Secretary and Treasurer	201.41		
Editor of Journal	71.79		
Counselor to AJAS	80.00		
Coordinator, Science Fairs	50.00		
Newsletter	112.80		
	$606.61	$ 606.61	
TOTAL		$3427.98	$3427.98
BALANCE, November 17, 1961			
Checking Account		397.00	
Savings Account		1072.43	
		$1469.43	$1469.43
		TOTAL	$4897.41

101. Motion by Twellmeyer, seconded by Eisele that the report of the Treasurer be accepted. Motion passed unanimously.

Report of the Councilor of the A.A.A.S. (DeVall for Yancey).

There has not been a meeting of the A.A.A.S. subsequent to our Spring Hill meeting. I plan to attend the Denver meeting of the A.A.A.S. during Christmas week.

102. Motion by Shotts, seconded by Thomson that the Report of the Councilor of the A.A.A.S. be accepted. Motion passed unanimously.

Report of the Editor and the Editorial Board (Hall).

This is a combined report of the Editor and Editorial Board of the Academy *Journal* and is primarily an account of the status of the *Journal*.

The printing contract has been awarded to the Bulletin Publishing

Company of Auburn. Progress in printing and distributing the *Journal* is:

June	Volume 31, Number 6, distributed to members.
August 15	Copy for Volume 32, Number 1, submitted.
August 22	Copy for Volume 32, Number 2, submitted.
September 11	All corrected galley proofs from authors returned to the printer.
October 14	Corrected page proofs returned to the printer.
November 17	Volume 32, Number 1, distributed to members.
November—	Volume 32, Number 2, will be ready for final printing in late November.

Materials for Volume 32, Numbers 3 and 4 are on hand and should be ready to submit to the printer in the next month.

Manuscript for the Academy History is in the final typing and according to Dr. Barker should be in the Editor's Office within the month. A final editing will then be done before submitting the Academy History to the printer. The cost of printing the Academy History is estimated to be $1000.00. Half of this amount is already in the Auburn University budget. The other half of this expense is to be paid by the Academy. For other expenses of publishing the *Journal* and of the Editor's office please refer to the Treasurer's Report.

103. Motion by Goetz, seconded by Fincher to accept the report of the Editor. Motion passed unanimously.

Report of the Counselor of the Alabama Junior Academy of Science (Wheeler).

The Executive Committee of the Alabama Junior Academy of Science held its annual fall meeting on November 4, 1961, with Professor G. O. Spencer, Local Counselor of A.J.A.S., on the Troy State College campus. Mr. John Thornton, president, Miss Sarah Campbell, vice-president, Mr. Bob Lumpkins, treasurer, were present. Mr. Charles E. Stewart, secretary, was represented by his sponsor, Miss Claudia Smith. All regional counselors (Miss Clustie McTyeire, Miss Ibbie Bradford, Dr. Harold Strickland, Dr. Francis Kearley, and Professor G. O. Spencer), along with permanent counselor R. E. Wheeler and associate counselor, Professor D. F. Butler, were in attendance. Plans for the annual meeting of the A.J.A.S. were discussed. The following items are herewith submitted for action:

1. The Alabama Junior Academy of Science annual meeting should be held concurrently with the Senior Academy. The recommended place and date of meeting: Troy State College, April 20-21.

2. A combined meeting for members of Alabama Junior Academy of Science and the Alabama Academy of Science should be held on Saturday morning at 10:00. It is recommended that all awards for both the Junior and Senior Academy be presented at this meeting (including Gorgas awards).

3. If banquet tickets to the Senior Academy banquet are provided without charge to members of the Alabama Academy of Science, free tickets to the Alabama Junior Academy of Science banquet should be provided for the members of the Senior Academy who are expected to attend the Junior Academy banquet.

4. The following budget, to be underwritten by the Senior Academy, is submitted for action of the Executive Committee:

Academy Award winner—Individual	$ 25.00
—School	25.00
Cups for exhibits and papers	175.00
A.J.A.S. *Newsletter*	75.00
Contribution to A.J.A.S. budget	100.00
Total	$400.00

5. A sum of $150 is recommended for the expense of the office of the permanent counselor to the Junior Academy with the stipulation that a maximum of $75 be used each year for operating expenses and the other $75 to be accumulated to apply toward the traveling expenses of the permanent counselor to a meeting of the American Association for the Advancement of Science.

6. An application to the Special Projects Section of the National Science Foundation has been submitted requesting $9000 to finance an Alabama Academy of Science Visiting Scientists' Program to the high schools of Alabama.

Dr. Francis Kearley has been appointed regional counselor of the Mobile Region. Also, the Alabama Junior Academy of Science is mailing quarterly to every white high school in Alabama a copy of the A.J.A.S. *Newsletter*. Eight lectures have been given or are scheduled under the A.J.A.S. sponsored volunteer lecture program at high schools.

The permanent counselor wishes to solicit pertinent suggestions that will contribute to the continued growth of the Junior Academy and to express appreciation for the enthusiastic support and interest expressed by the Senior Academy. A permanent counselor must be elected in 1962 for a three-year term.

104. Motion by Boozer, seconded by Wilks that the Report of the Counselor of the Alabama Junior Academy of Science be accepted with the deletion of two items. Motion passed unanimously.

Report of Coordinator of Regional Science Fairs (Twellmeyer).

All of the Regional Science Fair Organizations have reported on the activities for the 1961 Regional Fairs. Two of the five regions in Alabama are now operated by non-profit, educational corporations. These are the Southeastern Region and the Mobile Region. The Central Region has established a tax-exempt trust fund as a basis of financing its operations. The Northeastern Region is operated by Jacksonville State College, a tax-exempt educational institution. The North Region reports that negotiations are in progress to establish its tax-exempt status. As soon as these negotiations are completed the question of soliciting funds from state-wide industries will be resumed.

CENTRAL REGION: Dr. Herbert McCullough, Coordinator, reports that 428 projects were entered in the 1961 fair. In spite of the very successful operation of this fair, Dr. McCullough is finding difficulty regarding finances. At the close of the fiscal period in July there was a deficit of $570.46. However, by October 23rd this deficit had been removed. It is hoped, that this unbalance of expenses over income can

be adjusted by closer budgeting and by tapping other sources of revenue. Contributions, for example, from the PTA of participating schools, although only $26.00 per school, amounted last year to over $600.00 in the Mobile Region. This matter will be brought before the meeting of the Committee on Regional Science Fairs which immediately follows this.

MOBILE REGION: Two hundred and sixty-two exhibits were entered in the Regional Fair. A limitation of eight to sixteen exhibits per school is imposed in this fair. For the first time the Mobile Region can report a net balance of $160.00 in its Trust Fund. For the first time a separate division was provided for junior high school exhibits. The Science Fair Committee of the Mobile Region filed Articles of Incorporation during the past Summer. These were probated August 4, 1961. The resulting corporation, known as The Mobile Regional Science Promoters Incorporated, has undertaken an extensive program of Aid to Education. The Committee on Aid to Education has assumed responsibility for the program of communications with the schools of the region, sponsors and teachers. It also has activated four other programs; of project advising, through the operation of advising panels, project nights and individual consultation; of supplying speakers and lecturers, for classes, meeting of chapters of the AJAS, Science Clubs, teacher substitutions; of career guidance by personal contact with students; and of public information. Its communications office also provides the services of arrangements for plant trips, providing judges and supplying literature to teachers. Other programs of Aid to Education are under consideration by the Committee.

NORTH REGION: Mr. Carlton D. Whitt, Coordinator, reports that 218 projects were entered in the 1961 Regional Fair. About thirteen thousand people viewed these exhibits and those of the local fairs in the region. This region is in sound financial condition showing a balance of $884.00 over the cost of operating the fair. As yet this region has not completed negotiations for tax-exempt status. By letter of September 21st, 1961, Mr. Carlton D. Whitt, tendered his resignation to be effective at the end of the National Science Fair-International at Seattle, Washington in May. Copies of this letter have been sent to the representatives of the four coordinating Institutions on the Science Fair Committee of the region and to Regional Counselor of the Alabama Junior Academy of Science. It is the duty of this committee to nominate Mr. Whitt's successor, who will then be appointed by the State Coordinator after consultation with the Permanent Counselor of the Junior Academy.

NORTHEASTERN REGION: Mr. Reuben B. Boozer, Coordinator, reports that 176 exhibits were entered in the second fair of this region. Between thirteen and fourteen thousand people viewed the exhibits in regional and local fairs. It was reported that the regional fair had a total of $793.35 from contributions and carry over from the previous year on which to operate. The cost of operation and balance or deficit had not been determined at the time the regional report was filed.

SOUTHEASTERN REGION: Mr. D. L. Kilbourn, retiring Secretary, reports that 426 projects were entered in the Regional Fair. Mr. Ray Allison has assumed the responsibility of Secretary for the region.

105. Motion by Shotts, seconded by Eisele that the Report of

the Coordinator of Regional Science Fairs be accepted. Motion passed unanimously.

Reports of the Section Vice-Presidents.

GEOLOGY AND ANTHROPOLOGY (Daniel): Approximately 142 letters to prospective members have been mailed. These letters explained the program planned for the Spring meeting of this section and invited each prospect to become a member. Approximately 60 letters to members of the section have been mailed. These letters explained the program planned for the Spring meeting of this section and requested each member to plan to attend the meeting. It is planned to have a geological field trip one day while anthropologists present papers. On the second day the geologists will present papers while the anthropologists attend a field trip. The vice-chairman will serve as the second chairman. This plan was adopted because of lack of interest shown by anthropologists in geology and the lack of interest shown by geologists in anthoropology.

FORESTRY, GEOGRAPHY AND CONSERVATION (McCullough): During the year the chairmanship of the Section passed to the Vice-Chairman at the demise of Dr. J. Allen Tower, who was chairman. Tentative plans have been prepared for the Section program for the next meeting of the Academy. Attention is being given to the need for increased membership in the Section, and considerable effort in this direction is being planned.

PHYSICS AND MATHEMATICS (DeVall for Carr): A letter has been mailed to all heads of departments of mathematics and physics in the colleges and universities of the state. This letter points out the contribution that can be made by their staff members to the scientific progress of our state, and urges them to have their staff and students participate in the Troy meeting. A copy of the letter is enclosed. A similar letter has been forwarded to industrial and governmental laboratories (Southern Research, NASA at Huntsville, Mitre Corporation, etc.) requesting those to participate also.

106. Motion by Wilcox, seconded by Eisele that all formal reports and those given verbally by Vice-Presidents be accepted. Motion passed unanimously.

The President called for reports from the Chairmen of Standing Committees.

Report of the Long-range Planning Committee (Wilcox).

In this informal report, we are seeking guidance and would like to have the following questions discussed briefly at the Executive Committee meeting on November 18, 1961. We would, of course, also welcome any further suggestions by Academy members. (1) Should the A.A.S. redefine its stated objectives? (2) Is it a good or bad policy for the Academy to initiate projects which may eventually become autonomous? (3) Should the Academy resume its studies of selected Alabama counties and present such studies as symposia at the regular state-wide meetings? (4)

Should a questionnaire be circulated among our membership to provide a list of scientific research projects which might be carried on, perhaps cooperatively, in the smaller liberal arts and teacher training colleges throughout the state? (5) Should an "Equipment Availability" list (for use or perhaps even an occasional loan) be drawn up for the use of all Academy members? (6) Could we make more effective use of our retired members by: (a) putting them to work in some of the above projects or in already existing Academy projects, or (b) using them as "Visiting Scientists" and "consultants" to high school and junior high school science teachers and supervisors?

107. Motion by Twellmeyer, seconded by Fincher that the report of the Long-range Planning Committee be accepted. Motion passed unanimously.

Report of the Admissions to Membership Committee (DeVall).

Total membership December 31, 1960	577
Reinstated Honorary Members	2
New applications approved	53

Section	Individual	Collegiate
Biological Sciences	12	1
Chemistry	8	
Geology and Anthropology	12	1
Forestry, Geography & Conservation	2	
Physics and Mathematics	4	2
Industry and Economics	0	
Science Education	2	
Social Sciences	7	
Medical Sciences	2	
Total	49	4
Total increase		53

Regular Membership (Loss)	
Resigned	7
Dropped, non-payment of dues	14
Deceased	3
Termination of Complimentary Membership	13
Total	37
Net Gain	18
Total Membership November 18, 1961	595

108. Motion by Daniel, seconded by Barrett that the report of the Admissions to Membership Committee be accepted. Motion passed unanimously.

Report of the Science Education Committee (Boschung for Patton).

The present report is a personal effort to state a problem and point out a timely opportunity for an attempt at solution. This report is based

on two assumptions: (1) The Alabama Academy of Science is and ought to be corporately interested in science education in the public schools of the state; (2) A realistic science education program requires close cooperation and communication of educational administrators with scientists interested in that program.

The first assumption probably needs no discussion. The choice of location for this meeting, the audience for this report, and the Academy's history all bespeak the close interest of the Academy in education at all levels. The second assumption, if valid, states our problem.

In terms of the experience and knowledge of the present chairman of this committee, the Alabama Academy of Science has been somewhat successful in demonstrating its interest in education, and outstandingly unsuccessful in establishing effective communication with the official representative of public-school education in the state. This failure to communicate is not due to lack of sincerity or high purpose or competence on the part of the Academy personnel who have made the effort—but they have failed.

Individually, some Academy scientists have been able to show interest and to help individual public-school teachers and administrators. This person-to-person contact has helped public-school instruction and has furnished insight to its problems for Academy members. National Science Foundation Institutes have multiplied these individual contacts but they remain individual contacts.

Corporately, the Academy has no obvious means within the state for further effort at official communication. But *two current national efforts involving scientists might stimulate the state education authorities to heed Academy scientists* if we can speak as state representatives of the nation's scientists. I refer to: (1) The cooperative study, with recommendations, on public-school teacher training and certification. This is sponsored by AAAS and the National Association of State Directors of Teachers Education and Certification; (2) The development and testing of high-school courses by the national organizations of biologists, chemists, geologists, mathematicians, and physicists.

109. Motion by Boschung, seconded by Shotts that the report of the Science Education Committee be accepted. Motion passed unanimously.

Report of the Editor of the NEWSLETTER (Mrs. Padgett).

The NEWSLETTER has been sent to the membership on schedule. The mechanics of preparation and mailing present problems at Huntingdon College and it is recommended that the Editor in the future be located where secretarial and mailing assistance are available. The Editor will submit her resignation from the position after the Spring meeting unless she moves her residence out of state prior to April.

110. Motion by Eisele, seconded by Goetz that the report of the Editor of the NEWSLETTER be accepted. Motion passed unanimously.

The following committees presented no formal reports: Membership, Research and Finance.

President called for items of Old Business.

It was recommended that the activities of the Science Education Committee and the special committee on Teachers Certification be combined.

The President reported that the By-laws Committee would make its report at the Spring Executive Meeting.

Mr. Goetz reported that the Academy Brochure had not been revised to the extent that a draft could be made available for review. Copy of the revision will be available for review prior to or at the Spring Executive meeting.

It was recommended that the membership and especially Section Vice-Presidents be notified of the rules for handling undergraduate and graduate research awards. The Secretary was instructed to obtain from the Chairman of the Research Committee such descriptive information as would be useful in calling this award to the attention of the membership. It was further recommended that the rules by which the awards are administered be carried in the next issue of the NEWSLETTER.

111. Motion by Wilks, seconded by Wilcox that the Secretary develop with the Chairman of the Research Committee such procedures as may be determined appropriate by which the Academy membership may be made aware of the undergraduate and graduate research awards. Motion passed unanimously.

President called for items of New Business.

Proposed 1962 budget was discussed by Treasurer Barrett.

PROPOSED BUDGET FOR 1962

ANTICIPATED INCOME			
Membership dues			$2715.00
Registration Fees, Annual Meeting			300.00
Gifts			50.00
Journal Sales			10.00
		TOTAL	$3075.00
ANTICIPATED EXPENSE			
Publication of Journal			$ 900.00
Publication of History			500.00
Assistance to Junior Academy			
Academy Award	Individual	$ 25.00	
	School	25.00	
Cups		175.00	
AJAS Newsletter		75.00	
Contribution to AJAS Budget		100.00	400.00
Student Research Awards			100.00
Research Grants			400.00

Academy Conference Assessment		10.00
Annual Meetings		
Programs and Other Expenses	300.00	300.00
Operating Expense		
Office of President	100.00	
Office of Secretary and Treasurer	200.00	
Office of Coordinator of Science Fairs	50.00	
Office of Editor of Journal	150.00	
Office of Permanent Counselor to AJAS	75.00	
Newsletter	100.00	675.00
	TOTAL	$3285.00
ANTICIPATED EXCESS OF EXPENSE OVER INCOME		$ 210.00

It was recommend that because of the separation of the banquet for the Senior and Junior Academies at the 1962 Annual Meeting, the amount budgeted for the Junior Academy banquet be deleted. The policy of budgeting funds for payment of expenses connected with the operation of the Junior Academy was questioned.

112. Motion by Twellmeyer, seconded by Wingo that the proposed budget for fiscal year 1962 be adopted with the deletion of the $500 allocated to the Junior Academy banquet. Motion passed unanimously.

113. Motion by Twellmeyer, seconded by Wilcox that the President instruct the Finance Committee to study ways and means of overcoming financial problems of the Academy and recommend procedures that would eliminate the need for preparing a deficit budget. Discussion revealed that the Executive Committee was concerned about the lack of adequate income to carry the program of the Academy. It was suggested that additional sustaining members might be obtained if names could be carried on either the front or back cover of the Journal. Motion passed unanimously.

It was recommended by the President, Secretary, and Chairman of Local Arrangements at Troy State College that the dates for the 1962 Annual Meeting be April 20-21. It was also pointed out that members could be adequately accommodated in motels located a convenient distance from the campus. A proposed schedule of activities for the Annual Meeting was distributed to the Committee.

114. Motion by Wingo, seconded by Twellmeyer that the schedule of activities proposed for the 1962 Annual Meeting including arrangements for the Executive Committee on April 19, the General Session, Business Session, Section Meetings and Academy Banquet on Friday, April 20, and the General Session and Section

Meetings proposed for Saturday, April 21, be adopted with the understanding that the Junior Academy would participate in the General Session on Friday and Saturday mornings and be invited to Section Meetings on Friday afternoon. Motion passed unanimously.

The President reported that the University of Alabama had extended an invitation to the Academy to hold its 1963 Annual Meeting on the campus of University of Alabama, Tuscaloosa, Alabama.

115. Motion by Goetz, seconded by Eisele that the Academy accept the invitation from the University of Alabama to hold its 1963 Annual Meeting on its campus and that the President acknowledge this invitation and accept it on behalf of the Academy. Motion passed unanimously.

The President and President-Elect reported their findings with regard to the desirability of encouraging Professional Engineers to affiliate with the Academy. Two suggestions were proposed that would permit engineers to affiliate with a new section of the Academy or with Section VI, Industry and Economics. It was the consensus of the Executive Committee that a new section should be created.

116. Motion by Goetz, seconded by Eisele that Article III of the By-Laws be amended to add a new section—Engineering—and that the Engineering Section be numbered X. The motion as provided for in Article IX regarding Amendments passed with one abstension.

117. Motion by Goetz, seconded by all devoted members of the Executive Committee that the meeting be adjourned.

The meeting was adjourned at 12:25 p.m.

W. B. DeVall, Secretary

SPRING EXECUTIVE COMMITTEE MEETING

Troy State College, Troy, April 19, 1962

The meeting was called to order at 8:40 p.m. The following members of the Executive Committee and guests were in attendance and were introduced by the Secretary: Paul C. Bailey, presiding, William J. Barrett, Reuben B. Boozer, Herbert Boschung. Clyde H. Cantrell, David J. Cotter, Thomas W. Daniel, Jr., David L. DeJarnette, W. B. DeVall, James F. Doster, Father Louis J. Eisele, S.J., Robert H. Garner, C. C. Hall, A. T. Hansen, A. F. Hemphill, Roscoe D. Kelley, H. A. McCullough, John McCullough, Kenneth Ottis, E. Carl Sensenig, Reynold Q. Shotts, G. O. Spencer, H. S. Strickland, J. Richard Thomson, George O. Twellmeyer, S.J., Mary E. Ward, R. E. Wheeler, Carlton D. Whitt, W. T. Wilks, W. J. Wingo, P. H. Yancey, S.J.

President Bailey welcomed all in attendance to the campus of Troy State College and expressed appreciation for the good turnout for the Executive Meeting. The prepared agenda for the meeting was called to the attention of those present.

118. Motion by Yancey, seconded by Hansen that the minutes of the Fall Executive Committee meeting held November 18, 1961, at Howard College be approved in the form prepared by the Secretary and distributed by mail. Motion passed unanimously.

Report of the Secretary (DeVall).

The Secretary has performed all routine functions of the office. His responsibilities have been lightened through the cooperation of Auburn University. This cooperation has been in the form of an annual budget for secretarial assistance.

The Secretary has addressographed for mailing all copies of the *Journal* and *Newsletter*. In addition the Secretary has mailed the program for the 39th Annual Meeting to all members. Notices of meetings have been distributed to members and to the Executive Committee. All section vice-presidents received instructions relative to programming the Annual Meeting. The membership list for each section was prepared in the Fall and sent to section vice-presidents.

Correspondence handled by the Secretary on behalf of the Academy increased during the last year. It has included correspondence with the AAAS, the National Society for Medical Research, officers of the Academy, Junior Academy and representatives at the host institution for the 1962 meeting.

The President and Secretary met with the Chairman of Local Arrangements at Troy State College in October. As a result of this meeting plans for the annual meeting were tentatively adopted. The plan was

presented to the Executive Committee at its fall meeting and adopted. It was then possible to instruct section officers how to make plans for their program. It is recommended that this procedure be followed each year.

119. Motion by H. A. McCullough, seconded by Eisele that the Secretary's report be accepted. Motion passed unanimously.

Report of the Treasurer (Barrett):

REPORT OF THE TREASURER
Covering the Fiscal Year January 1961 through December 31, 1961

BALANCE, January 1, 1961			$2755.67
RECEIPTS			
Membership dues		$ 726.00*	
Gifts and Contributions		60.00	
Sale of Journal		2.00	
AAAS Research Grant		200.00	
Annual Meeting			
Registration Fees	$246.00		
Banquet tickets	228.50		
E. H. Sargent and Co.	521.50		
Miscellaneous receipts	.50	996.50	
Research Grant Returned		150.00	
Expense Advance Returned		.50	
Interest on Savings Account		23.24	
TOTAL RECEIPTS			$4913.91
EXPENDITURES			
Publication of Journal		716.50	
Assistance to AJAS			
Awards	150.00		
Cups	142.50		
Pins, guards, etc.	37.38		
Contribution to AJAS Budget	20.00	349.88	
Student Research Award		15.00	
Research Grants		450.00	
Academy Conference Assessment		11.68	
Annual Meeting			
Banquet	1215.00		
Programs and Other Expense	307.31	1522.31	
Operating Expense			
Office of President	90.61		
Office of Secretary and Treasurer	248.30		
Office of Editor of Journal	71.79		
Office of Counselor of Science Fairs	50.00		
Newsletter	112.80	653.50	
Refund of Excess Dues Payment		2.00	
TOTAL EXPENDITURES			$2720.87

BALANCE, December 31, 1961		
Savings Account	1072.43	
Checking Account	120.61	1193.04
TOTAL		$4913.91

* Because the date for mailing of dues statements has been changed from November to January, the amount received for membership dues during fiscal 1961 does not represent a full year's dues receipts, but represents only that part of 1961 dues received after January 1, 1961. Dues statements for 1962 were not mailed until January 1, 1962. This change was made so that, in the future, the annual calendar year fiscal statement will more accurately reflect the year's financial operations.

120. Motion by Thomson, seconded by Shotts that the Treasurer's report be accepted. Motion passed unanimously.

Report of the Editor of the *Journal* (Hall):

Issue No. 2 of Volume 32 has been mailed to the membership. Galley proofs for issue No. 3 of Volume 32 have just been received from the printer. These galley proofs will be returned to the printer by April 24 and the issue should be in the mail in about two weeks. Copy for issue No. 4 of Volume 32 will be submitted to the printer as soon as issue No. 3 is completed. Other issues are tentatively assembled.

In addition to regular issues the *Academy History* has been submitted to the printer. The *History* as submitted is two hundred and forty pages in length but should be something less than this in printed form.

As to the future, the printer and the editor have hopes of getting the *Journal* back on or much closer to schedule this summer.

121. Motion by Cantrell, seconded by Hansen that the Editor's report be accepted. Motion passed unanimously.

Report of the Permanent Counselor of the Junior Academy (Wheeler):

On November 4, 1961, the Executive Committee of the Alabama Junior Academy of Science met and made plans for the annual convention to be held concurrently with the Senior Academy on the Troy State College campus.

During the year, routine procedures were followed to encourage scientific research and study. Four A.J.A.S. *Newsletters* (September, November, January, March) were mailed to each white high school in Alabama, regardless of whether they were associated with the Alabama Junior Academy of Science. It is believed that these activities encouraged better exhibits and papers on the regional level as well as general improvement of scientific study.

ASSETS	July 1, 1960	$421.70
	July 1, 1961	$413.30
	July 1, 1962 (expected)	$440—$460

MEMBERSHIP: At this meeting charters will be granted to eleven new chapters. Four clubs will be reinstated. This will make a total

membership of active members in the Alabama Junior Academy of Science of 107.

Mobile Region—Senior High Members—0 new members; Total 20.

North Alabama Region—Mrs. Ibbie K. Bradford, Florence, Counselor; Senior High Members—1 new member; Total 20.

North Central Region—Miss Clustie McTyeire, Hueytown High, Counselor; Senior High Members—5 new members; Total 27.

Northeastern Region—Dr. Harold Strickland, Counselor; Senior High Members—4 new members; Total 31.

Southeastern Region—Prof. G. O. Spencer, Troy State College, Counselor; Senior High Members—1 new member; Total 18.

EXHIBIT COMPETITION: For the first time some of the exhibit competition at the A.J.A.S. Convention will be between regional science fair winners (excluding finalists to National Science Fair). This is an experiment and your comment on the outcome will be greatly appreciated.

VISITING SCIENTISTS PROGRAM: During the year the Alabama Junior Academy of Science has sponsored on a voluntary basis a Visiting Scientists Program at the local level. Many lectures have been given in the Birmingham area, and a number have been scattered throughout the state.

The Permanent Counselor of the Alabama Junior Academy of Science would like to express his appreciation to the Senior Academy for the support and cooperation given during his term of office, and encourage the same type of assistance and cooperation with the new Permanent Counselor.

122. Motion by Barrett, seconded by Thomson that the report of the Permanent Counselor be accepted. Motion passed unanimously.

Report of the Co-ordinator of Regional Science Fairs (Twellmeyer):

REGIONAL FAIRS: Four Regions held their fairs the weekend of March 22-24, 1962; Northeastern Region held its fair weekend of March 29-31, 1962.

FINALISTS TO NATIONAL SCIENCE FAIR-INTERNATIONAL:

Central Region: William Fieselman, Birmingham; Carol Ann West, Hueytown.

Mobile Region: Wayne Garrison, Brewton; Linda Holk, Magnolia Springs.

North Region: John Thornton, Huntsville; Anna Kathryn Schaefer, Decatur.

Northeastern Region: John Duff Quenelle, Sycamore; Creed Clayton, Fort Payne.

Southeastern Region: No finalists.

COMPANIONS FOR FINALISTS FROM FIVE REGIONS: Dr. Herbert A. McCullough—for boys; Mrs. R. L. Crawford, Jr.—for girls.

OTHER MEMBERS OF STATE DELEGATION TO NSF-I: Northeastern Region: Mrs. Marion Heaton, Educator, Sylacauga High School. Southeastern Region: Mrs. Elsie Reid, Educator, Parrish High School,

Selma; Mr. Talmadge Ostwald, Educator, Cloverdale High School, Montgomery.

TRIP ARRANGEMENTS TO NSF-I: Airline reservations from Mobile, Birmingham and Huntsville to Seattle were made through the State Coordinator's Office. The return trip was arranged for Sunday, May 6, in order to give the members of the delegation the opportunity to spend Saturday at the Century 21 Exposition. Hotel reservations were also made through the State Coordinator's Office. All are supposed to be in the same, first class hotel but they are not the accommodations requested. Science Service is having great difficulty because a number of the large hotels are not abiding by their room commitments.

REGIONAL CO-ORDINATORS: Dr. Herbert A. McCullough of the Central Region and Mr. Carlton D. Whitt of the North Region have resigned as of the end of the 1962 operational year. Dr. Edward Robinson has been appointed to succeed Dr. McCullough. Mr. Whitt's successor has not been appointed. Until such time as the Committee of Representatives of the coordinating institutions of the North Region nominates a successor to Mr. Whitt and he is appcinted, the said committee will be responsible for the operation of this fair. The members representing the coordinating institutions are: University of Alabama Center, Huntsville—Dr. F. H. Mitchell; Athens College, Athens—Dr. William A. Short; Saint Bernard College, Cullman—Rev. Victor Clark, O.S.B.; and Florence State College, Florence—Mr. T. N. Hubbuch. The Academy owes an expression of appreciation to these two retiring coordinators for the years of ably operating their respective regional fairs under the sponsorship of the Academy.

REGIONAL FAIR REPORTS: Two regions have reported to date. The Northeastern Region reports 287 exhibits entered in the fair from 54 participating schools. There were an estimated 3,500 people who viewed the exhibits. Contributions received to date amount to $1238.00.

The Mobile Region reports 388 exhibits entered in the fair from 36 participating schools. It is estimated that between 4,000 and 5,000 viewed the exhibits. Total receipts from contributions for financing of the fair are $2035.00 to date.

SOLICITATION OF STATEWIDE INDUSTRIES: Letters were sent to two industries requesting a single contribution for the five regional fairs according to the policy adopted at the November 18, 1961 meeting of the Committee on Regional Science Fairs. Because there was objection on the part of one regional organization, in order to avoid confusion, all efforts in this matter were stopped until there could be a reconsideration of the policy.

SCIENCE FAIR POSTER: For the first time the five regions sent out a poster covering the essentials of the five fairs held in Alabama. These were apparently very well received.

FINALISTS' EXHIBITS: Finalists to the National Science Fair-International are unable to exhibit at the State meeting of the Academy because of the late date. Their exhibits had to be sent to Seattle not later than April 18. In future, it is hoped that the meeting of the Academy will not be later than the second weekend in April.

123. Motion by Wingo, seconded by Shotts that the report of

the Co-ordinator of Science Fairs be accepted and that the Secretary be instructed to write letters of appreciation on behalf of the Academy to retiring regional co-ordinators—Dr. Herbert A. McCullough of the central region and Mr. Carlton D. Whitt of the north region. Motion passed unanimously.

Report of the Coordinator with Science Clubs of America (Strickland for Kassner):

Several years ago the state was organized into four, and later five, regions under the supervision of two people, one representing the Junior Academy and the other the Science Fairs. We have somewhat the same setup on the state level, i.e., a coordinator for Science Clubs and a coordinator for Science Fairs. Some science club sponsors have indicated that the two programs were not sufficiently integrated in most of the regions and have requested that this lack of coordination be brought to the attention of the Executive Committee.

Fundamentally there is no real difference between the two programs —exhibits are developed by members of science clubs, supervised, in most cases, by the club sponsor or someone else; and entered for competition at the regional meeting. Since two students in each region are selected to receive an all-expense trip to the National Science Fair, the regional meetings have been largely publicized as Science Fairs with little or no credit given to the Alabama Junior Academy of Science.

One typical area of complaint is represented in the following quotation which is taken from a letter received from a science club sponsor with more than 25 years experience working with the Science Clubs and the Junior Academy—"The rules say that a club *must submit* a group and not a project by an individual. I don't get this? What is the reasoning back of this? I thought we were to develop interest in research on an individual basis. How can this be done by group projects? . . . I hope that the day will come when we get the Science Fairs and the A.J.A.S. completely coordinated." Similar complaints have come from other science club sponsors, all of whom have been very active in the Junior Academy for many years.

Complaints have come to my attention from high school students, parents and teachers from all over the state, as well as judges, deploring the practice of many high school principals who require all students taking science to enter a project in their local science fair. Many young people, although very interested in the sciences, are not sufficiently developed to choose one particular field, which they must do in order to work up a project. Consequently, they present projects merely to get a grade and lose interest before they have had an opportunity to explore and find their own particular field. This definitely is not the way to develop scientists and should be stopped.

Your Coordinator for Science Clubs has not been closely enough associated with the regional organizations in recent years to make any definite recommendation. However, I feel that the president-elect should be authorized to appoint a committee which should study the overall problem and report to the fall executive meeting of the Academy.

Albert Einstein said, "Making allowances for human imperfections, I do feel that in America the most valuable thing in life is possible, *the development of the individual and his creative powers.*" This is why the Junior Academy was organized and what it has attempted to do from its inception in 1932.

The job of Coordinator for Science Clubs of America embraces work with Negro Science Clubs as well as Science Clubs in the white high schools. There are more than 70 active Negro high school science clubs in Alabama. These clubs hold an annual convention similar to our Junior Academy annual meeting. The state is organized into nine regions. Eliminations are held at the high school and regional levels. The best exhibits in three categories—not necessarily first, second and third place winners—are entered in competition at the State Fair at Stillman College. This year there were 25 very good exhibits in chemistry and approximately 70 exhibits in all at the State Fair. First and second place winners received four-year and three-year tuition scholarships while the third place winner received a cash award.

I have enjoyed working with the Academy for the past 25 years and I feel that I should be allowed to retire from active duty with this report.

124. Motion by H. A. McCullough, seconded by Twellmeyer that the report of the Coordinator with Science Clubs of America be received. Discussion on the motion brought out questions regarding the accuracy of certain statements in the report and the types of projects entered in Science Fairs. Progress made by Science Fairs and cooperation between science fair leaders and the Junior Academy were discussed by counselors working with these groups. It was emphasized that in addition to exhibits, papers are prepared. It was suggested that regional counselors meet with Junior Academy counselors as a committee to discuss ways and means of further improving cooperation. Attention of the membership was directed to the composition of the Committee on Junior Academy and its duties as set forth in the *Journal* of the Academy, Vol. 31, No. 1, page 57. Further general discussion emphasized ways and means used to motivate students to participate in science projects. Motion passed unanimously.

125. Motion by H. S. McCullough, seconded by Wheeler that designated officers of the Academy discuss with Dr. Kassner the importance of the coordinator's position with Science Clubs of America and invite him to continue serving the Academy in this capacity. Motion passed unanimously.

Report of the Councilor of the A.A.A.S. (Yancey):

I attended the two meetings of the Council and that of the Academy Conference of the AAAS in Denver during Christmas week. The agenda for the meetings of the Council were prepared by the new Committee

on Council Affairs. It was reported by the Retiring President, Chauncey Leake, that the AAAS had a net gain in membership during the year of 6,500 and was operating on a $2,000,000 budget. Five new affiliates were added. Alan T. Waterman, Director of the National Science Foundation, was elected President-Elect. The Study Committee on International Scientific Communication submitted the following recommendations, which were adopted: (1) that the AAAS sponsor an International Science Register; and (2) that the AAAS promote other symposia similar to the one on Chinese Science which was very successful. The Committee on Science and the Promotion of Human Welfare reported that a Commission on Air Conservation had been set up and a sub-committee to study the problems of modern warfare and human survival. The Committee on Public Understanding of Science reported that several projects had been started under the leadership of Edward G. Sherburne. One of these was a series of "Holiday Science Lectures," the first being given at the very time in San Francisco for high school students. The name of the Pharmacy Section was changed to Section on Pharmaceutical Sciences. Two new sections were added: (1) Information and Communication; and (2) Statistics. The Council passed to the Committee on Science and the Promotion of Human Welfare two resolutions by the American Association of Scientific Workers on nuclear testing and shelters. A third resolution regarding the NSF fellowship requirement as regards Communism, was referred to the Board of Directors with the sense that "any criterion other than merit is unwise." Publication of the *AAAS Bulletin* was resumed. At the Academy Conference I presented our annual report, prepared after consultation with President Bailey and Secretary DeVall. New officers elected were: Secretary—J. Teague Self, University of Oklahoma; President-elect—G. Gerald Acker, Bowling Green State University, Ohio; President—E. Ruffin Jones, University of Florida. The Academy Conference received $10,500 from the NSF to study junior and collegiate academies. Heads of junior academies are requested to send to the Secretary of the Conference information about their activities. The NSF has made available to state academies money for Visiting Scientists to junior academies.

126. Motion by Shotts, seconded by Barrett that the report of the Councilor of the A.A.A.S. be accepted. Motion passed unanimously.

The President called for reports from Section Vice-Presidents. Those in attendance indicated that they would make no formal report at this meeting since each had programmed his section meeting and the printed program would reflect the activities of the respective sections since the Fall Executive Meeting.

The meeting was recessed from 9:40 p.m. to 9:55 p.m.

Report of the Committee on Research (Sensenig):

No formal report was presented. Members were encouraged to submit requests for research grants. Interest in obtaining grants has lagged

somewhat. Available funds with which to support grants should be used during the year for which they are appropriated.

127. Motion by Shotts, seconded by Wingo, that the report of the Committee on Research be accepted. Motion passed unanimously.

Report of the Committee on Admission to Membership (DeVall):

Total Membership December 31, 1960	577
Reinstated Honorary Members	2
Reinstated Individual Members	2
New Complimentary Members	45
New Applications Approved	58

Section	Individual	Collegiate	
Biological Sciences	13	1	
Chemistry	8		
Geology and Anthropology	14	3	
Forestry, Geography & Conservation	2		
Physics and Mathematics	4	2	
Industry and Economics	0		
Science Education	3		
Social Sciences	6		
Medical Sciences	2		
Total	52	6	
	Total Increase		107

Regular Membership (Loss)		
Resigned	18	
Dropped, non-payment of dues	25	
Deceased	4	
Termination of Complimentary Membership	44	
Total Loss		91
Net Gain		16
Total Membership December 31, 1961		593
New Applications approved January 1, 1962 thru April 9, 1962		40

The report of the Committee on Admission to Membership was accepted as read.

Report of the Committee on Science Education (Bailey):

Activity of this committee for the past year has been nil. I do plan to display, at the Troy meeting, literature including the 1961 AAAS-NASDTEC Guidelines pamphlets in quantity, hopeful that our members will gain more information and interest in the possibility of scientists' working systematically and concretely with educational specialists in this state for improvement of science education.

The report of the Committee on Science Education was accepted as read.

Report of the Committee on the Newsletter (Cotter):

The basic problem facing the Editor of the Newsletter is news solicitation. Of the 60 correspondents on the list obtained from Mrs. Padgett only 15 responded to the call for news. An attempt to broaden the scope of news solicitation and the enlistment of more correspondents will be made for the second newsletter. Total expense of Newsletter, first issue was $21.44.

The report of the Committee on the Newsletter was accepted as read.

Report of the Committee on Archives (Cantrell):

During the past year the Archivist has performed the usual duties connected with his office. These consist of the following: (1) Mailing issues of the *Journal* to the membership and to the exchange accounts; (2) Approving payments for publication of the *Journal* against Auburn University Library funds and receiving reimbursement of one-half said amounts from the AAS Treasurer; (3) Selling issues of the *Journal*, when requested, and transferring funds of such sales to the Treasurer; (4) Handling correspondence regarding the *Journal* received from the membership, the exchange accounts, and others; (5) Supervising the filing of such materials as are needed for the permanent records as they are relayed to the Archivist by the President and other officers; (6) Initiating and/or entering into exchange agreements whereby the *Journal* is sent in exchange for similar publications.

The exchanges continue to remain at approximately the same figure —about 125 titles. Members of the Executive Committee and of the Alabama Academy of Science are invited to call the attention of the Archivist to any suitable materials which should be obtained as exchanges. Members of the Alabama Academy of Science may request loans of any material on the exchange list. Such requests may be handled as interlibrary loans, or members may write directly to the Archivist, stating that they request such loans as members of the Alabama Academy of Science.

It was suggested that the list of exchanges used by the Archivist be included in a forthcoming issue of the Newsletter. Without further discussion the report of the Archivist was accepted as read.

A report on the status of the History of the Academy was presented by the Archivist on behalf of the members of a special committee charged with its preparation and editing.

After many years of work on the part of many people, the History of the Alabama Academy of Science is about to be published. The original manuscript covered far too many pages to make publication possible with funds available. I was involved with finishing a doctoral dissertation and could not do further work on the manuscript at that time. Dr. Sam Barker, past president, and our president at this time, Dr. Paul Bailey, graciously contributed their time and efforts in con-

densing the manuscript to publishable size. The History is a composite publication and represents the work of many authors and editors. We have done everything possible to keep errors from the publication. The manuscript is in the hands of the printer and publication can be expected within a matter of weeks. I feel that you will want to have the advice and counsel of the printer. Mr. President, I beg permission to read the essential parts of a letter dealing with this matter. (Here Cantrell read the letter from Mr. Neil O. Davis of the Bulletin Publishing Company, dated 17 April 1962.) The published volume will mean a great deal more, as Mr. Davis has pointed out, if published separately. The printer would use the same weight material for the cover of the History as used now for the *Journal* but of a different color. The printing of 1200 copies can be arranged with funds available ($500 from the AAS and $500 from Auburn University).

There are several questions to be answered: (1) Shall we follow the advice of the printer and publish the History separately as recommended? (2) Who will receive a free copy of the History? (3) What price shall we charge for copies sold? (4) Shall we send out review copies? To whom? (5) What date shall we list on the title page?

The President called for comments on the report. The questions raised by the Archivist were discussed at length.

128. Motion by Yancey, seconded by Sensenig that those who have served in an editorial capacity preparing the History of the Academy exercise discretion in deciding the feasibility of publishing the History separate from the *Journal*, or as previously agreed on by the Executive Committee, in the form of an extra number of the *Journal*. Motion passed unanimously.

129. Motion by Wilks, seconded by Ottis that copies of the printed History of the Academy be distributed without charge to all members including honorary members whose dues for 1962 have been paid as of April 21, 1962 and that collegiate, junior and complimentary members be excluded from the list of members receiving the History without charge. Motion passed unanimously.

130. Motion by Twellmeyer, seconded by Ottis that copies of the History of the Academy be sold at $1.00 per copy to all junior, collegiate, and complimentary members as well as members in other categories who join the Academy after April 21, 1962. Motion passed unanimously.

131. Motion by Twellmeyer, seconded by Thomson that the price of the History to non-members of the Academy be set at $2.00 per copy. After discussion of the method of financing the publication of the History and potential revenue that could be earned through sales, the motion passed unanimously.

132. Motion by Yancey, seconded by Wheeler that the Archivist and editors who have worked on the History of the Academy

use discretion and judgment in deciding which publication media should receive review copies of the History. Motion passed unanimously.

Report of the Committee on Local Arrangements (Wilks).

Plans for all activities connected with the 39th Annual Meeting of the Alabama Academy of Science have been completed. Section officers have been asked to make known their needs that have not been accommodated by contacting personnel at the registration desk. Each member and visitor is welcomed to the campus of Troy State College and is invited to inspect all campus facilities.

The President called for items of Old Business.

Report of the Special Committee on By-laws (McCullough).

The committee submitted its report in the form of a revised set of By-laws. It contained all changes previously approved by the Executive Committee since 1959. Additional changes were also proposed.

133. Motion by Ottis, seconded by Wilks that Article I be amended by making changes in wording as recommended by the special committee. Motion passed unanimously.

134. Motion by Barrett, seconded by Wheeler that the membership classification, Patrons, provided for in Article I, Section 1 (f) be abolished. Motion passed unanimously.

135. Motion by Wingo, seconded by Barrett that the dues of Life Members of $50.00 as provided in Article I, Section 1 (g) be changed to $100.00. Motion passed unanimously.

136. Motion by Barrett, seconded by Wheeler that the membership classification for Sustaining Members and Industrial Members as provided in Article I, Section 1 (i) and (j) respectively, be deleted and that a new membership classification, Contributing Member, be established for any individual, organization or institution paying $25.00 or more per annum. Motion passed unanimously.

137. Motion by H. A. McCullough, seconded by Thomson that Motion 133 be rescinded and that Article I be amended by incorporating the changes approved in Motions 134, 135, and 136 and that the Secretary be instructed to make the necessary changes including numbering of sections and to prepare a draft of the revised Article I, as amended. Motion passed unanimously.

The committee recommended the adoption of Article II without change.

138. Motion by Twellmeyer, seconded by Wheeler that the per annum dues of Fellows be made consistent with dues paid by In-

dividual Members and that the amount be $5.00 per annum. Motion passed unanimously.

139. Motion by H. A. McCullough, seconded by Hall that in view of the changes made in Article I, Article II, Section 1 be amended and that the dues for Life Members be increased from $50.00 to $100.00; that Sections 6 and 8 be deleted; that the category Contributing Member be added with dues set at $25.00 or more per annum, and that the Secretary be instructed to renumber the classes of membership and arrange them in a sequence consistent with the membership classifications set forth in Article I, as amended. Motion passed unanimously.

The By-laws Committee recommended adoption of Article III in its present form (with previous changes incorporated) but with the deletion of the article "the" preceding the name of Section VIII.

140. Motion by Boozer, seconded by Ottis that Article III be amended by incorporating the recommendations of the By-laws Committee. Motion passed unanimously.

The By-laws Committee recommended that the Chairman of the Finance Committee be added to item 4 of Article IV.

141. Motion by Ottis, seconded by Boozer that Article IV, part 4, Committees, be amended as recommended by the By-laws Committee. Motion passed unanimously.

The By-laws Committee recommended that there be deleted from Article V, Section 16, the phrase "the Chairman of this committee shall be a member of the Long-Range Planning Committee."

142. Motion by Yancey, seconded by Shotts that the deletion in Section 16 be approved. Motion passed unanimously,

143. Motion by McCullough, seconded by Boozer that Section 9 of Article V be reworded to state that "the Editor of the *Journal* shall be responsible for the publication of *The Journal of the Alabama Academy of Science.*" Motion passed unanimously.

144. Motion by Barrett, seconded by Shotts that Article V be amended to include the changes approved by the Executive Committee in Motions 142 and 143. Motion passed unanimously.

The By-laws Committee recommended that Article VI, Program Rules, be revised to reflect the current methods of operation relative to programming the Annual Meeting.

145. Motion by Shotts, seconded by Ottis that Article VI be amended as recommended by the committee and that the Secretary program a draft of the revised Article, as amended. Motion passed unanimously.

The By-laws Committee recommended that the word "annually" that appears in Article VII be deleted and replaced by the word "quarterly." This would accurately reflect the current publication schedule of the *Journal* of the Academy.

146. Motion by Shotts, seconded by Hall that Article VII be amended by making the word change recommended by the By-laws Committee. Motion passed unanimously.

The By-laws Committee recommended that a new Article IX, Regional Science Fairs, replace the existing Article IX and that it should read "The Academy shall sponsor the Alabama Regional Science Fairs. The State Coordinator of Science Fairs is an officer of the Academy and is elected as provided in Article VIII of the Certificate of Incorporation."

147. Motion by McCullough, seconded by Barrett that the By-laws be amended and that the new Article IX recommended by the By-laws Committee be adopted and incorporated in the By-laws. Motion passed unanimously.

148. Motion by Shotts, seconded by Hall that the existing Article IX, Amendments, be renumbered Article X in view of the action taken in Motion 147. Motion passed unanimously.

149. Motion by Twellmeyer, seconded by Wingo that a complete redraft of the By-laws as amended by the Executive Committee at this meeting be prepared by the Secretary; that copies be distributed to all members of the Executive Committee; and that after review by members of the Executive Committee the amended By-laws be carried in a forthcoming issue of the *Journal*. Motion passed unanimously.

The President called for items of New Business.

It was announced by Wheeler that the Academy had received approval by the National Science Foundation of a grant in the amount of $8,200 to support a Visiting Scientist Program. It was recommended that a Steering Committee be formed, that a director be appointed, and that the Steering Committee be authorized to reapply for an extension of the grant at the end of the first year.

150. Motion by Wheeler, seconded by Boozer that a Steering Committee for the National Science Foundation grant consisting of the President, Immediate Past President, the President-elect and the Treasurer of the Alabama Academy of Science and a director, be authorized to administer the grant and the program supported by it. Motion passed unanimously.

151. Motion by Ottis, seconded by Eisele that Dr. R. Wheeler

be appointed director of the Visiting Scientists Program and that he, with the officers named in Motion 150, proceed immediately to implement the grant program. Motion passed unanimously.

152. Motion by Wingo, seconded by Shotts that the Steering Committee as constituted in Motion 150 be authorized to present an enlarged proposal for the 1963-64 school year to the National Science Foundation on or before October 15, 1962. Motion passed unanimously.

The committee discussed possible dates for the 1963 Annual Meeting. The Committee on Place of Meeting was asked to consider the dates in April 1953 that would not conflict with holiday periods or scheduled scientific meetings and to report at the business meeting of the Academy on April 20, 1962.

Several members of the Executive Committee expressed concern about the legislation pending in the Federal Congress that would limit or prevent the use of animals in experimental research studies. This matter was referred to the Resolutions committee with a request that it present a resolution to the Business Session of the Academy on April 20, 1962, for consideration by the membership.

The meeting was adjourned by the President at 11:50 p.m.

W. B. DeVall, Secretary

ANNUAL BUSINESS MEETING

Troy State College, Troy, April 20, 1962

The meeting was called to order at 1:30 p.m. by President Bailey.

The minutes of the Annual Business Meeting held at Spring Hill College, April 7, 1961, were read by the Secretary. The minutes were corrected as follows: The balance, December 31, 1960, of $6809.08 as reported by the Treasurer was corrected to read $2749.67; the name of Richard W. Griffin was deleted from Item 2 of the Report of the Resolutions Committee since it was learned that this member was not deceased. The President declared the minutes as read by the Secretary and corrected by the membership approved.

Report of the Secretary (DeVall).

Routine business of the Executive Committee of the Academy was transacted Thursday, April 19, including reports of officers and committee chairmen. Thirty-one persons attended.

The History of the Academy was reported by the Archivist as in press and should be ready for release in June. The Executive Committee by motion approved its mailing to members whose dues are paid as of April 21, 1962. Excluded from the mailing will be collegiate, junior, and complimentary members. All persons who become dues-paid members after April 21, 1962 and junior, complimentary and collegiate members may purchase one copy at $1.00. Copies will be sold at $2.00. Review copies will be sent to a selected list of publications.

The ad hoc Committee on By-laws presented a set of revised By-laws incorporating all past amendments since 1957. A few points were clarified and membership categories were revised. Duties of standing committee chairman were spelled out.

Revised By-laws will be distributed to the Executive Committee and will be carried in a forthcoming issue of the *Journal.*

A NSF grant of $8,200 has been approved that will enable the Senior Academy to sponsor a visiting scientist program. A director and steering committee will administer the program.

Registration at the 39th Annual Meeting included 138 members and guests representing 21 organizations, agencies, and institutions:

I.	Biological Sciences	46
II.	Chemistry	10
III.	Geology and Anthropology	17
IV.	Forestry, Geography and Conservation	9
V.	Physics and Mathematics	16
VI.	Industry and Economics	0
VII.	Science Education	27
VIII.	Social Sciences	6
IX.	Medical Sciences	5
	Total	138

As of January 1, 1962, life members were: Charles M. Goethe; John F. Herndon; James F. Sulzby; Bernard C. Weber.

153. Motion by Eisele, seconded by Carmichael that the report of the Secretary be accepted. Motion passed unanimously.

Report of the Treasurer (Barrett).

A summary of the detailed report presented to the Executive Committee follows:

Balance, January 1, 1961	$2755.67
Receipts	$2158.24
Expenditures	$3720.87
Balance, December 31, 1961	$1193.04

154. Motion by Carmichael, seconded by Fincher that the summary report of the Treasurer be accepted. Motion passed unanimously.

Report of the Committee to Membership.

Total membership, December 31, 1960	577
Increase in membership including reinstatements and new members	107
Loss in membership	91
Total membership December 31, 1961	593
Net gain in membership for 1961	16

155. Motion by Arnold, seconded by Carmichael that the Report of the Committee on Admission to Membership be accepted. Motion passed unanimously.

Report of the Auditing Committee for the Senior Academy (Hanson).

We, the Audit Committee, have found the books of the Treasurer of the Alabama Academy of Science to be in order as of the 10th day of April, 1962.

156. Motion by Shotts, seconded by Carmichael that the report of the Audit Committee be accepted. Motion passed unanimously.

The President called for a report of the Audit Committee for the Alabama Junior Academy of Science. Chairman McCullough stated that no formal audit had been made. The committee will make an audit when permanent counselor Wheeler retires from office and all records have been reconciled.

Report of the Resolutions Committee (Ottis).

Your Resolutions Committee submits, herewith, the following resolutions:

1. Whereas the Alabama Academy of Science is successfully completing its thirty-ninth annual meeting, now let it therefore be resolved: (a) That appreciation be forwarded to Dr. W. A. Gardner, the founder of the Alabama Academy of Science, for his kind letter and words of encouragement for the future of the Academy; (b) That the Academy express its appreciation to Troy State College and to its President, Dr. Frank Stewart, for their kind hospitality; (c) That special appreciation be expressed for the work of William T. Wilks and G. O. Spencer and their associates who have so effectively provided the local arrangements for both the Senior and Junior Academies; also to Dr. Wilks for support and encouragement of the Gorgas Talent Search; (d) That the gratitude of the Academy be expressed to the Birmingham Division of the E. H. Sargent and Company for their hospitality again in providing for the Annual Dinner; (e) That appreciation be expressed to Dr. Paul Bailey and others for their toils and labors on bringing the History of the Alabama Academy of Science to fruition.

2. Whereas, there are two proposals before Congress to provide Federal regulation of animal experimentation in our colleges and universities in the person of the Griffiths Bill and the Moulder Bill; Whereas,

the Griffiths and Moulder Bills will require licensing of every scientist, and certification of all laboratories in which federally supported animal experimentation is conducted; Whereas, these bills will require prior approval of all research plans, prior approval of all changes in scientific procedures to be employed, and numerous scientifically *superfluous* records and reports; Let it be resolved, that the Alabama Academy inform as many persons as possible as to the true character of the debate over federal regulation of animal experimentation; That the Academy promote and support a positive program toward animal experimentation rather than this elaborate plan of harassment authored by persons known, not for their contributions to biology but rather for their anti-vivisectionist type sabotage; Further, be it resolved that the Secretary of this Academy be instructed to advise our representatives in Congress on the thinly-disguised, *anti-animal* research provisions of the Griffiths and Moulder Bills and to urge that sound, helpful Federal programs be considered instead of this harassment type of legislation.

3. Whereas, during the past year, death has deprived the Academy of four of its members; now let it therefore be resolved that the Academy express its sympathy to the families and friends of MR. C. G. SHARP, MR. H. G. PALLISTER, DR. J. ALLEN TOWER, and MR. P. P. POWELL, and to voice its appreciation for the loyal and valuable services which they gave to the Academy, and that copies of this resolution be sent to their families and be spread upon the minutes of this Academy.

157. Motion by Fincher, seconded by Diener that the report of the Resolutions Committee be acepted with minor changes and with the addition of the names, J. Allen Tower and P. P. Powell, to the list of deceased. Motion passed unanimously.

Report of the Committee on Place of Meeting (Boschung).

The Committee recommends that the 40th Annual Meeting of the Alabama Academy of Science be held on the campus of the University of Alabama.

158. Motion by Boschung, seconded by Hanson that the report of the Committee on Place of Meeting be accepted and that the meeting be held April 4-6, 1963. Motion passed unanimously.

Report of the Nominating Committee (Shotts).

The Nominating Committee, consisting of Reynold Q. Shotts, David L. DeJarnette, and H. Ellsworth Steele, submits the following slate of officers for the ensuing year:

President	Louis J. Eisele, S.J.
President-Elect	E. Carl Sensenig
Secretary	W. B. DeVall
Counsilor of the AAAS	Patrick Yancey, S.J.
Permanent Counselor of the Junior Academy	G. O. Spencer
Coordinator of Science Fairs	George Twellmeyer, S.J.
Coordinator with Science Clubs	R. E. Wheeler
Trustee	Dr. Ralph B. Draughon
Trustee	Dr. C. M. Farmer

Vice-Presidents and Vice-Chairmen of Sections:

I	Vice-President	J. Richard Thomson
	Vice-Chairman	Urban L. Diener
II	Vice-President	Robert H. Garner
III	Vice-President	A. T. Hansen
	Vice-Chairman	Douglas Jones
IV	Vice-President	Earl J. Hodgkins
	Vice-Chairman	G. W. Smalley, Sr.
V	Vice-President	Roscoe Kelley
	Vice-Chairman	Hoyt Kaylor
VI	Vice-President	Perry C. Covington
	Vice-Chairman	James R. Goetz
VII	Vice-President	James Boyles
	Vice-Chairman	Ruby Countryman
VIII	Vice-President	Chester W. Hartwig
	Vice-Chairman	E. C. Overton
IX	Vice-President	Earl G. Hammel, Jr.
	Vice-Chairman	Margaret Klapper

159. Motion by Carmichael, seconded by Diener that the report of the Nominating Committee be accepted, that all nominees be declared elected to their respective offices for the periods indicated, and that the Secretary distribute to the members of the Executive Committee the complete list. Motion passed unanimously.

The meeting was adjourned by the President at 2:03 p.m.

W. B. DeVall, Secretary

ALABAMA ACADEMY AWARD

The Alabama Academy of Science made its annual presentation of The Academy's Award to Outstanding High School Science Teachers at the 39th annual meeting of the Academy in Troy on April 20, 1962. Recipient of this year's award was Miss Claudia Doris Smith of Minor High School, Birmingham.

The Award is given annually to a high school science teacher for meritorious teaching of science. The Academy Award is one of the highest honors that is conferred upon a science teacher in Alabama. The purpose of the Award is to recognize those teachers who go beyond the classroom to stimulate scientific endeavor among their students. The Award consists of a citation and a gold pin.

Miss Smith was born in Tuscaloosa County and received her

early education at the county schools in Northport, Alabama. She graduated from the University of Alabama in 1940 with an A.B. degree, majoring in chemistry and minoring in mathematics and English. In addition to graduate work at the University of Alabama and Alabama College, Miss Smith has attended two summer institutes for high school science teachers sponsored by the National Science Foundation. She has taught science and mathematics in the junior and senior high schools in Alabama for 17 years and has taught science at Minor High School in Jefferson County since 1953. Miss Smith has worked with the Alabama Junior Academy of Science for the past 25 years and has attended twenty annual conventions of the Academy with the science club.

Dr. James L. Kassner, Ramsay Professor of Chemistry, University of Alabama, and Chairman of the Award Committee, made the presentation at the banquet of the Alabama Junior Academy of Science.

GORGAS SCHOLARSHIP FOUNDATION

Report of The Scholarship Committee 1961-62

The annual Alabama State Science Talent Search completed its ninth year under the sponsorship of the Gorgas Scholarship Foundation, Inc. The winners from the white high schools were announced at the annual meeting of the Alabama Academy of Science on April 20, 1962, at Troy State College. The winners from the Negro high schools were announced at Southern Research Institute, Birmingham, on June 2, 1962.

Fifty-nine seniors representing twenty-three white high schools (public and private) in the state of Alabama completed the aptitude examination which was conducted by Science Clubs of America and administered by Science Service for the Westinghouse Science Scholarships.

Of these students, ten finalists were invited to appear before a board of judges during the annual meeting of the Alabama Academy of Science at Troy State College on April 19, 1962. At that time they explained their science projects and were interviewed by each of the judges. The winners were announced at the Junior

Academy of Science banquet by Emmett B. Carmichael, Chairman, The Gorgas Scholarship Foundation.

	Name	High School
1st Award	Chenault, Alice A.	Decatur
2nd Award	Summerville, R. H.	Tuscaloosa
3rd Award	Flank, H. H.	Huntsville
4th Award	Whitson, J. P.	Talladega
1st Alternate	Tully, D. B.	Semmes
2nd Alternate	Martin, T. F.	Ensley
3rd Alternate	Dishner, Gayla M.	Shades Valley
4th Alternate	Spradling, C. G., Jr.	Ensley
5th Alternate	Yarbrough, Linda K.	Decatur
6th Alternate	Padgett, E. M.	Evergreen

Thirty-six seniors representing seven Negro high schools in Alabama completed the aptitude examination which was conducted by the Science Clubs of America, and administered by Science Service for the Westinghouse Science Scholarships. Of these students, four were selected as finalists and were invited to the Southern Research Institute, Birmingham, for an interview on June 2, 1962. At that time they explained their science projects.

	Name	High School
1st Award	Hooten, Henry	Tuskegee Institute, Tuskegee
1st Alternate	Coar, Thelma M.	A. H. Parker, Birmingham
2nd Alternate	Hawkins, L. A.	A. H. Parker, Birmingham
3rd Alternate	Marsh, W. F.	G. W. Carver, Montgomery

Judges

Charles E. Feazel, Co-Chairman
Wynelle D. Thompson, Co-Chairman

E. Scott Barr
L. L. Bennett, Jr.
E. L. Bishop
D. F. Butler
E. D. Chastain
Irvin Citron
R. L. Chermock

Thomas I. Hicks
James L. Kassner
Julian D. Mancill
F. H. Mitchell
G. D. Palmer
Ernest D. Riggsby
Edward L. Robinson

Kenneth Coons
Thomas E. Cole
Virgil Collins
Urban Diener
Robert Dietz
E. B. Dismukes
R. H. Garner
Margaret Green
C. C. Hall
Eric Rodgers
C. L. Seebeck, Jr.
Septima Smith
John Still
W. H. Venable
A. C. Willhelm, Jr.
W. J. Wingo
Robert N. Whitehurst
James W. Woods

BY-LAWS OF THE ALABAMA ACADEMY OF SCIENCE

(Revised by action of the Executive Committee)

April 19, 1962

Article I. MEMBERSHIP CLASSIFICATION

Sec. 1. The membership of the Academy shall consist of the following classes:

a) *Individual Members:* Indvidual membership of the Academy shall be open to any man or woman in the State of Alabama who is actively engaged in science, either pure or applied, and who has received a four-year collegiate degree, or who has had a minimum of ten years professional or industrial experience. Two years may be deducted from this minimum of ten years for each year the individual spent in college.

b) *Associate Members:* Any adult interested in the promotion of science in Alabama who does not qualify for the grade of individual member shall be eligible for associate membership.

c) *Collegiate Members:* Any college student interested in the promotion of Science in Alabama may qualify as a collegiate member.

d) *Junior Members:* High school seniors, whose Science Club is in full standing with the Alabama Junior Academy of Science, and who have presented a paper before a regional meeting of the Junior Academy or who have presented an exhibit at the Annual Meeting of the Junior Academy, may become Junior Members of the Senior Academy.

e) *Honorary Members:* Members of the Academy who have received recognition beyond the State of Alabama shall be eligible for honorary membership. Not more than two honorary members shall be elected in any one year.

f) *Life Members:* Any member of the Academy may become a life member by paying into the treasury the sum of One Hundred Dollars ($100.00).

g) *Fellows:* Members of the Academy who are Fellows of the American Association for the Advancement of Science shall be classed as Fellows of the Academy.

h) *Complimentary Members:* Persons entitled to such membership shall be sponsors of AJAS Chapters. The Permanent Counselor to the Junior Academy shall officially certify to the Secretary of the Academy by January 1 of each year those persons and their addresses entitled to such membership.

i) *Contributing Members:* Any individual, organization or institution may be classed as a contributing member by paying into the treasury of the Academy annually $25.00 or more.

Sec. 2. Associate Members, Junior Members, and Collegiate Members shall not hold office or vote, but may present papers before the Academy without introduction.

Sec. 3. No one shall be eligible for office who is in arrears in the payment of dues.

Sec. 4. The membership year and the fiscal year shall correspond to the calendar year. New members joining prior to July 1 shall be mem-

bers for that calendar year. New members joining on July 1 or thereafter shall choose whether their membership shall cover the current year or the year following.

Members in arrears with their dues for two consecutive years shall be dropped from the rolls except that members in any of the armed forces in time of war shall be excused from the payment of dues. Members so dropped, however, may be reinstated at any time upon payment of dues for the current year and one year preceding.

Sec. 5. All members in good standing except Junior Members shall receive a subscription to the *Journal*. No member will receive a copy of the *Journal* until he has paid his dues for the year of the annual meeting covered by that *Journal*. Moreover, unless he has paid his dues by the time the *Journal* goes to press, he cannot be sure of receiving a copy.

Sec. 6. All applications for membership must be indorsed by at least three members in good standing, regardless of the qualifications of the applicant for membership on other grounds.

Article II. DUES

Sec. 1. The dues for the several classes of membership shall be as follows:

1. Individual Members, Five Dollars ($5.00) per annum.
2. Associate Members, Three Dollars ($3.00) per annum.
3. Collegiate Members, One Dollar ($1.00) per annum.
4. Junior Members, One Dollar ($1.00) per annum.
5. Honorary Members, none.
6. Life Members, One Hundred Dollars ($100.00).
7. Fellows, Five Dollars ($5.00) per annum.
8. Complimentary Members, none.
9. Contributing Members, Twenty-Five Dollars ($25.00) or more per annum.

Article III. SECTIONS

Sec. 1. The Academy shall have the following scientific sections:

I. Biological Sciences
II. Chemistry
III. Geology and Anthropology
IV. Forestry, Geography and Conservation
V. Physics and Mathematics
VI. Industry and Economics
VII. Science Education
VIII. Social Sciences
IX. Medical Sciences
X. Engineering

Sec. 2. Each Vice-President shall be Chairman of his Section. Each Vice-chairman shall act as Secretary of his Section. The Vice-chairman of each section shall become the Chairman of the Section the following year.

Article IV. COMMITTEES

Sec. 1. Standing committees of the Academy shall be set up as indicated below and serve for the terms and purposes stated.

1. *Steering Committee:* The Steering Committee consists of the President, Past President, President-elect, Secretary and Treasurer.

2. *Committee on Membership:* This committee consists of the Vice-chairman of the sections with the President-elect as chairman.

3. *Committee on Research:* This committee is appointed by the President.

4. *Committee on Long-Range Planning:* The Chairman retires at the end of each year, but for the purpose of continuity in planning may be reappointed by the incoming President until he has served three years. The Chairman of the Finance Committee is a member of this committee.

5. *Committee on Finance:* This committee consists of eight members appointed by the President, the Chairman of which is to be a leading business man or industrialist. The Chairman of the Research Committee is a member of this committee.

6. *Committee on Admission to Membership:* The Secretary shall be chairman of this committee and the President-elect and Councilors of the A.A.A.S. shall serve as additional members.

7. *Auditing Committee:* The President shall appoint annually two auditing committees of two members each, one for the Senior Academy and one for the Junior Academy.

8. *Editorial Board:* The Editorial Board shall consist of three members, each appointed for a term of three years, with the editor of the *Journal* as an additional member ex officio. The members are so appointed that only one appointment is made each year.

9. *Committee on Junior Academy:* This committee shall consist of the counselors of the several regions, the state officers of the Junior Academy of Science, the sponsors of the state officers of the Junior Academy, and the three counselors elected by the Alabama Academy of Science.

10. *Committee on Place of Meeting:* A month or more before the annual meeting, the President shall appoint a committee of five.

11. *Committee on Local Arrangements:* The President shall appoint a chairman, one to serve for the Senior Academy and one to serve for the Junior Academy. Each chairman shall have the power to select members of his committee.

12. *Committee on Science Education:* This committee is appointed by the President. The Chairman and Vice-chairman of the Science Education Section and the Coordinator of Science Fairs are ex officio members.

13. *Committee on the Newsletter:* The President shall appoint a Chairman of the Newsletter Committee. The Chairman, in consultation with the President, shall select the members of his committee.

14. *Committee on Public Relations:* This committee shall be appointed by the President.

15. *Committee on Archives:* The President shall appoint a chairman of the Committee on Archives, who shall be the Archivist.

16. *Committee on Regional Science Fairs:* This committee shall con-

sist of the State Coordinator of Science Fairs and Regional Coordinators of the several regions.

Article V. DUTIES OF OFFICERS AND COMMITTEES

Sec. 1. *Trustees:* The duties of the trustees are as enumerated in the Certificate of Incorporation. They shall have the right to hold meetings, both regular and special, at such times and places as may be convenient and at such meetings a majority of the trustees shall constitute a quorum for the transaction of any business which may come before them.

All funds of the Academy which may come into the custody of the trustees shall be carried in a separate bank account in the name of the Academy. The trustees may designate one or more of their number to sign checks drawn to such account.

Sec. 2. *Executive Committee:* The duties of the Executive Committee are as set forth in the Certificate of Incorporation. At the first business session of the Executive Committee at the time of the annual meeting the President shall name a nominating committee to nominate officers of the Academy, including the Vice-chairman; nominations for Vice-chairman may be suggested by section Vice-presidents.

The Executive Committee shall meet at least twice annually. The first meeting being called by the President in the fall. The second meeting shall be immediately before the annual meeting of the Academy. The Executive Committee shall consider at these meetings such business as may properly be brought before it and shall make recommendations for action by the business sessions of the entire Academy.

Special meetings of the Executive Committee may be held whenever called by a majority of the members thereof, or by the President. Timely notice of a meeting stating the time and place thereof and indicating briefly the object thereof, shall be given the members of the committee, by mail, publication, or by other suitable means whereby the notice may be conveyed. At all meetings of the Executive Committee, regular or special, the members present shall constitute a quorum for the transaction of any business which may come before it.

Sec. 3. *President:* The President shall preside at the sessions of the Academy as a whole, and of the Executive Committee.

He shall appoint all committees except as otherwise herein provided.

He shall deliver the Presidential Address at the annual banquet at the end of his tenure of office. The text of the address shall be published in the *Journal,* either in full, in abstract or by title, as he desires.

Sec. 4. *President-Elect:* The President-elect shall perform the duties of the President in the latter's absence. He shall serve as Chairman of the Committee on Membership.

Sec. 5. *Vice-Presidents:* The Vice-Presidents shall preside as Chairmen of their respective sections and, in the absence of the President and the President-elect, at sessions mentioned in Section 2 hereof.

They in cooperation with the Vice-chairmen shall be responsible for the planning and arranging of programs for their respective sections.

They in cooperation with the Vice-chairmen shall endeavor to build the membership of their respective sections.

Sec. 6. *Secretary:* The Secretary shall keep the minutes of the Executive Committee and of the Academy as a whole.

He shall be responsible for the arrangements of the annual meeting, including the drawing up of the general program and the arranging of the sectional programs sent him by the section chairmen.

He shall keep the membership roll of the Academy, including rank, section, member of the A.A.A.S. etc.

He shall act as Chairman of the Committee on Admission to Membership and shall notify applicants for membership of their selection or non-selection.

At the close of the annual meeting, he shall provide the Treasurer with a list of the members.

He shall perform such other duties as may be assigned to him by the Executive Committee.

Sec. 7. *Treasurer:* The Treasurer shall be in charge of all funds of the Academy, derived from membership fees and dues, but not special funds held by the trustees, as provided in the Certificate of Incorporation. The Treasurer shall keep all funds belonging to the Academy in a separate bank account. The Treasurer is charged with the duties of sending notes relating to dues and the collection of dues.

He shall make only such disbursements as are approved by the President.

He shall check the membership roll furnished him by the Secretary, for payment of dues, and forward the revised roll to the Editor of the *Journal.*

Sec. 8. *Councilor of the A.A.A.S.:* The Councilor of the A.A.A.S. shall represent the Academy on the Council of the A.A.A.S. and the Academy Conference, and shall attend any other meetings of the A.A.A.S. conventions which he shall deem of interest to the Academy.

He shall report at the annual meeting on the meetings of the Council and the Academy Conference.

He shall be a member of the Committee on Admission to Membership.

Sec. 9. *Editor of the Journal:* The Editor of the *Journal* shall be responsible for publication of the *Journal of the Alabama Academy of Science.*

He shall be a member of the Editorial Board, ex officio.

Sec. 10. *Counselors of the Junior Academy:* The Counselors of the Junior Academy shall supervise the activities of the Junior Academy for the Senior Academy.

Sec. 11. *Co-ordinator with Science Clubs of America:* The Co-ordinator with Science Clubs of America shall act as liaison officer between the Academy and Science Clubs of America and also between the Academy and the Gorgas Scholarship Foundation.

Sec. 12. *State Co-ordinator of Regional Science Fairs:* The State Co-ordinator of Regional Science Fairs shall supervise the activities of the Regional Science Fairs.

Sec. 13. *Steering Committee:* The Steering Committee is authorized to handle routine jobs of the Academy which shall arise between Executive Committee meetings. It is responsible to the Executive Committee and is not authorized to make major decisions for the Academy.

Sec. 14. *Committee on Membership:* This committee shall, through

its statewide membership, seek to secure new members, solicit Contributing Memberships, and handle such investigations and projects as may be assigned to it by the officers or committees of the Academy.

Sec. 15. *Committee on Research:* The Committee on Research shall encourage scientific research in Alabama, by whomsoever initiated and conducted, investigate possible sources of funds to be awarded by the Academy to research scientists, and make recommendations on the placing of such funds where they will likely be of the greatest possible use to scientific research. This Committee shall collaborate with the Committee on Long-Range Planning.

Sec. 16. *Committee on Long-Range Planning:* It shall be their responsibility to formulate and promote long-range plans for broadening and intensifying the activities of the Academy so that a maximum number of workers in its various fields shall share in and contribute to the progress and prosperity of our State.

Sec. 17. *Committee on Finance:* The duties of the Committee on Finance shall be to promote the financial welfare of the Academy.

Sec. 18. *Committee on Admission to Membership:* This committee shall examine the qualifications of the applicants for membership and assign them to the different grades of membership. They shall keep a complete and up-to-date record of the membership of the Academy.

Sec. 19. *Auditing Committee:* The Auditing Committee shall examine and report to the Academy upon the financial record of the Treasurers of the Academy and the Junior Academy respectively at the meeting for which they were appointed.

Sec. 20. *Editorial Board:* The Editorial Board shall concern itself with broad editorial policies and with problems of finance and shall act in a general advisory capacity to the Editor of the *Journal.*

Sec. 21. *Committee on Junior Academy:* The duties of this committee shall be to co-ordinate the activities of the several regions of the Junior Academy in cooperation with the Co-ordinator on Regional Science Fairs, to promote the organization of chapters and by all possible means promote the welfare of the chapters, the regions and the entire Junior Academy.

Sec. 22. *Committee on Place Meeting:* This committee is to make recommendations at the annual business meeting concerning the time and place for holding subsequent annual meetings.

Sec. 23. *Committee on Local Arrangements:* This committee shall have the responsibility of providing for the physical needs of the Academy at its annual meeting. The Chairman of the Local Arrangements Committee for the Senior Academy shall work closely with the President and the Secretary relative to all aspects of the meeting; the Chairman of the Committee for the Junior Academy shall work closely with the Counselor of the Junior Academy.

Sec. 24. *Committee on Newsletter:* The Committee on the Newsletter shall prepare and forward to the members a newsletter. The newsletter shall be published at regular intervals determined by the President and Chairman of the committee. The Chairman of the Committee on Newsletter shall act as Editor of the Newsletter.

Sec. 25. *Committee on Science Education:* This committee will have

as its primary function the evaluation of science education in the state at all academic levels, and the formulation of ideas to improve the present system where possible.

Sec. 26. *Committee on Public Relations:* This committee shall seek adequate publicity for the meetings and work of the Academy.

Sec. 27. *Committee on Archives:* The Archivist shall keep in a safe place the Archives of the Academy consisting of back numbers of the *Journal,* exchange publications, and records of the Academy.

Sec. 28. *Committee on Regional Science Fairs:* The Committee on Regional Science Fairs shall co-ordinate the activities of the Regional Science Fairs in cooperation with the counselors of the Junior Academy of Science.

Article VI. PROGRAM RULES

Sec. 1. Titles and abstracts of papers to be presented at the annual meeting of the Academy must be sent in duplicate to the Chairman of the Section in which the paper is to be presented before the date set for him. Non-members may read papers on the invitation of the respective Section Chairman.

Sec. 2. The Section Chairman shall compile the section program and forward it with the abstracts of the papers to the Secretary by the date set.

Sec. 3. The program of the Annual Meeting shall include the following features:

1. A meeting of the Executive Committee;
2. The Annual Business Meeting of the Academy;
3. Sectional meetings;
4. Annual banquet;
5. Other activities in keeping with the purposes of the Academy which, from time to time, may be desirable.

Article VII. JOURNAL

Sec. 1. The *Journal* of the Academy shall be published quarterly. It shall contain an account of the business transacted at the annual meeting, papers of outstanding merit, abstracts of all other papers, and such other materials as the Editor and the Editorial Board may think proper.

Article VIII. THE ALABAMA JUNIOR ACADEMY OF SCIENCE

Sec. 1. The Academy shall sponsor the Alabama Junior Academy of Science, composed of high school science clubs.

Sec. 2. Counselors of the Junior Academy are officers of the Academy and are elected as provided in Article VIII of the Certificate of Incorporation.

Article IX. REGIONAL SCIENCE FAIRS

Sec. 1. The Academy shall sponsor the Alabama Regional Science Fairs.

Sec. 2. The State Co-ordinator of Regional Science Fairs is an officer

of the Academy and is elected as provided in the Certificate of Incorporation.

Article X. AMENDMENTS

Sec. 1. The By-Laws may be amended by a plurality vote of the Executive Committee present at any annual meeting, or at any special meeting for that purpose.

This is to certify that to the best of my knowledge and belief this document is a correct copy of the By-Laws of the Alabama Academy of Science into which have been incorporated approved changes made during my term as Secretary, March 1959-April 1962.

May 7, 1962 *s/ W. B. DeVall*
Secretary

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal should be addressed to the Archivist.

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
AUBURN UNIVERSITY
AUBURN, ALABAMA

VOLUME 33 | OCTOBER, 1962 | NUMBER 4

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

VOLUME 33 OCTOBER, 1962 NUMBER 4

The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

CONTENTS

ARTICLES

ABSTRACTS

The Effect of Annexation Upon Centralization And Suburbanization in The Metropolitan Centers of Alabama, 1950 to 1960

Henry L. Andrews
University of Alabama

Recent concern for the establishment of a Department of Urban Affairs at the cabinet level in the federal government suggests something of the significance of problems that the growth of cities and their environs has generated in the United States. The magnitude and importance of redistribution of urban population has recently been an object of special study and research (1).

Although Alabama probably has not lost its rural "image," it had for the first time in the 1960 census a majority of its people living in cities. While the total population of the state increased by only seven per cent from 1950 to 1960, the urban population increased by thirty- four per cent, and the rural population declined by fourteen per cent. Urban growth in Alabama, as in other states, has been characterized by considerable increase in the population residing in metropolitan centers. During the last decade, the population living in metropolitan centers of the state increased twenty-one per cent while that living outside the metropolitan centers decreased by three per cent.

THE PROBLEM

Although the trend toward metropolitan growth throughout the nation has been characterized by a decline in the population residing in the central city and a rapid increase in suburban residence, expansion of city boundaries through political annexation tends to conceal the true pattern of growth in large urban centers. This study attempts to determine the effect of the expansion of city boundaries upon the process of centralization and decentralization in the metropolitan centers of Alabama.

PROCEDURE

In analyzing the process of metropolitan growth it is essential to consider as a unit the entire population in and around large cities whose activities constitute a functional system of social and economic relationships. To serve this purpose, the United States Bureau of the Census has developed the concept of metropolitan area.

This census unit was first defined in 1930 and redefined in the censuses of 1950 and 1960. The 1960 unit is called the Standard Metropolitan Statistical Area and was prepared by the Bureau of the Budget to provide a uniform area to be utilized by all federal agencies in compiling statistics for population and general purpose (3). By this delineation, every city of 50,000 or more inhabitants in 1960 is included in a standard metropolitan statistical area which is bounded by county lines. The population of the standard metropolitan statistical areas of each state is divided into two components, central city and outside central city. Central city is an "urban place" of 50,000 inhabitants or more and outside central city is the remainder of the territory within the boundary of the unit in which the central city is located.

For the first time in 1960 the Census recorded population residing in cities as the area of the city was defined at the previous decennial census. This makes possible an adjustment in population change during the decade 1950 and 1960, holding area constant. Thus, the effect of the expansion of city boundaries by political annexation upon the process of centralization and decentralization in metropolitan centers can be examined (2).

RESULTS

There are six standard metropolitan statistical areas in Alabama, each containing a single central city of 50,000 or more inhabitants and each bounded by the lines of the county in which the central city is located.

Distribution within metropolitan areas.—In 1950, approximately one-half or more of the population of each of the metropolitan centers of Alabama, with the exception of the Huntsville area, resided in the central city component of the area. By 1960, the central city component represented the largest proportion of the population in each of the metropolitan areas of the state (Table 1). The range of variation in population living in central city at the beginning of the decade was from almost one-fourth in the Huntsville area to more than three-fourths in the Montgomery area. However, in 1960 the range of variation was from slightly more than one-half in the Birmingham area to approximately four-fifths in the Montgomery area. Obviously, the extent to which annexation affects change in central city and outside city population is concealed by these data.

Component change in population of metropolitan areas before and after adjustment for annexation.—Table 2 shows decennial change in the population of component units of the metropolitan

areas of Alabama from 1950 to 1960 and type of growth for each metropolitan area before and after adjustment for annexation of territory by central cities (4). Before adjustment, central city population of the metropolitan centers of the state collectively increased more than twice as fast as the population residing outside central city. However, after adjustment for expansion of city boundaries, gain in population outside central city was more than five times the rate of growth for central city component.

The process of growth in population for the individual metropolitan centers reveals significant variation. Before adjustment for annexation, rate of growth was substantially higher for central city than for outside city in all metropolitan areas except the Birmingham area, and the outside city segments of the Huntsville and Tuscaloosa areas actually declined in population. Further, the most phenomenal gain in central city population was in the Huntsville area. Adjustment for expansion of city boundaries reveals a shift in which outside city population increased much more rapidly than that of central city with the exception of the Huntsville area, and the central city population of the Gadsden area actually declined. Further, the most rapid gain in the population residing outside central city was in the Mobile area.

TYPE OF GROWTH

Pattern of growth for each individual metropolitan center of the state may be described by the relation between relative change in the population residing in central city and outside central city for the ten-year period 1950 to 1960. Three types of change resulting in relative centralization and three types resulting in relative decentralization of population are theoretically possible (2):

Centralizing patterns.—

I. Central city gains population while outside city loses:
II. Central city and outside city gain population but central city gains at faster rate;
III. Central city and outside city lose population but central city loses at a slower rate;

Decentralizing patterns.—

IV. Central city and outside city gain population but outside gains at faster rate;
V. Outside city gains population while central city loses;
VI. Central city and outside city lose population but outside city loses at slower rate.

Patterns of change represented in types III and VI above are not revealed in standard metropolitan statistical areas of Alabama.

Growth types before and after adjustment for annexation.— Table 2 shows that Alabama metropolitan areas were collectively characterized by the centralizing pattern, or growth of central city over outside city prior to adjustment of population for expansion of city boundaries. However, after this adjustment the collective growth pattern was that of decentralization, or popularly, suburbanization.

Viewed separately, each of the metropolitan areas of the state, before consideration of annexation, showed growth by centralization with the exception of the Birmingham area. After the adjustment, all of the areas revealed a decentralized growth pattern except the Huntsville area. Although the Gadsden metropolitan area grew by the decentralizing process, the specific type of change was increase in outside city population while population of central city declined. On the other hand, the metropolitan areas of Birmingham, Mobile, Montgomery, and Tuscaloosa showed the decentralized type of growth characterized by increase in population of both components of the metropolitan area with outside city gaining at a faster rate than central city. Variations in this regard were, however, quite marked with outside city growth in the Birmingham area being forty-seven times more rapid than growth in central city; eight times as fast in the Mobile area; four times as rapid in the Montgomery area; and almost twice as fast in the Tuscaloosa area. The only exception to decentralized growth after adjustment for annexation, the Huntsville area, revealed a central population increase of approximately two and one-half times that of the outside city component.

CONCLUSIONS

Analysis of population growth by component parts of metropolitan areas, taking political annexation into consideration, demonstrates that expansion of city boundaries is a significant factor affecting the process of metropolitan growth in Alabama and differential patterns of growth within the metropolitan centers of the state. Political annexation apparently tends to overstate growth of the central city component and to understate growth of the outside city component of metropolitan areas. Adjustment for annexation shifts the type of metropolitan growth for the state from one resulting from centralization to one resulting from decentralization.

The one deviant pattern in the process of metropolitan growth in Alabama is represented in the Huntsville metropolitan area where both components are gaining population but central city is gaining at

a more rapid rate than the outside city component. The "mushroom" growth of the Huntsville area appears to reflect metropolitan immaturity in the sense of rapid population concentration as a response to the highly localized special need in the development of Redstone Arsenal and the Marshall Space Flight Center rather than population concentration as a direct function of the basic process whereby central city integrates the social and economic activity of a wider and wider geographical area.

Knowledge concerning patterns in the redistribution of the urban population of Alabama suggests a need for study of numerous problems involving social planning and urban redevelopment.

TABLE 1. DISTRIBUTION OF ALABAMA POPULATION RESIDING IN STANDARD METROPOLITAN STATISTICAL AREAS AND COMPONENT UNITS, 1950 AND 1960

Standard Metropoltan Statistical Area And Component Unit	Population 1960	Population 1950	Per Cent Of Total 1960	Per Cent Of Total 1950
Birmingham Area	634,864	558,928	100.0	100.0
Central City	340,887	326,037	53.7	58.3
Outside City	293,977	232,891	46.3	41.7
Gadsden Area	96,980	93,892	100.0	100.0
Central City	58,088	55,725	59.8	59.4
Outside City	38,892	38,167	40.2	40.6
Huntsville Area	117,348	72,903	100.0	100.0
Central City	72,365	16,437	61.7	22.5
Outside City	44,983	56,466	38.3	77.5
Mobile Area	314,301	231,105	100.0	100.0
Central City	202,779	129,009	64.5	55.8
Outside City	111,522	102,096	35.5	44.2
Montgomery Area	169,210	138,965	100.0	100.0
Central City	134,393	106,525	79.4	76.7
Outside City	34,817	32,440	20.6	23.3
Tuscaloosa Area	109,047	94,092	100.0	100.0
Central City	63,370	46,396	58.1	49.3
Outside City	45,677	47,696	41.9	50.7

Source: United States Census of Population: 1960, Vol I, Characteristics of the Population, Part A, Number of Inhabitants, Table 11 of State Reports.

TABLE 2. NUMBER AND PER CENT CHANGE IN POPULATION, 1950 TO 1960, BY COMPONENTS OF METROPOLITAN AREAS OF ALABAMA AND TYPE OF GROWTH FOR METROPOLITAN AREAS BEFORE AND AFTER ADJUSTMENT FOR ANNEXATION

AREA	BEFORE ADJUSTMENT					AFTER ADJUSTMENT				
	Central City		Outside City		TYPE*	Central City		Outside City		TYPE*
	Number	Per Cent	Number	Per Cent		Number	Per Cent	Number	Per Cent	
All Areas	191,743	28.1	60,112	11.8	II	50,830	7.5	201,035	39.4	IV
Birmingham Area	14,850	4.6	61,086	26.2	IV	2,136	0.7	73,800	31.7	IV
Gadsden Area	2,363	4.2	725	1.9	II	-1,155	-2.0	4,243	11.1	V
Huntsville Area	55,928	340.3	-11,483	-20.3	I	18,357	111.7	26,088	46.2	II
Mobile Area	73,770	57.2	9,426	9.2	II	11,395	8.8	71,801	70.3	IV
Montgomery Area	27,868	26.2	2,377	7.3	II	14,111	13.2	16,134	49.7	IV
Tuscaloosa Area	16,974	36.6	-2,019	-4.2	I	5,986	12.9	8,969	18.8	IV

* Pattern of metropolitan growth resulting from relation between relative change in population residing in central city and outside city.

LITERATURE CITED

(1). For example, Bogue, Donald J., Population Growth in Standard Metropolitan Areas 1900-1950. (Housing and Home Finance Agency 1953). Hawley, Amos H., The Changing Shape of Metropolitan America. (Glencoe, Illinois, Free Press. 1956). Shryock, Henry S., Jr., Population Redistribution Within Metropolitan Areas, Evaluation of Research, Social Forces, 35. 154-59 December 1956.

(2). Schnore, Leo F., Municipal Annexations and the Growth of Metropolitan Suburbs. 1950-60. American Journal of Sociology. 67:406-17. January 1962.

(3). United States Census of Population. 1960. Vol. I. Characteristics of the Population, Part A, Number of Inhabitants, pp. XXIII-XXIV. Table 11 of State Reports.

(4). Based upon United States Census of Population. 1960. Final Reports PC (1), 2A, Alabama, Table 9.

ABSTRACTS

Section I—Biological Sciences

Preliminary Studies on the Effects of Isocaloric Synthetic Diets on Mouse Tumors

J. Richard Thomson
Southern Research Institute

The evaluation of experimental cancer chemotherapy data is not a quick and easy task. Proper evaluation and interpretation of such data are dependent upon full cognizance of each of the parameters of the experiment, keeping always in mind the effects and possible interactions of each of the parameters. It is well known in certain tumor systems that simple caloric restriction will significantly inhibit tumor growth. In certain experiments, non-lethal drug toxicity and associated reduction of food intake (and host inanition) can easily be mistaken for specific and meaningful drug "activity." These "weight-loss false positives" are some of the most serious sources of misinterpretation in the evaluation of experimental anticancer drugs.

In an effort to elucidate this problem, experiments have been designed to determine the tumor-inhibiting effects of specific weight loss caused by caloric restriction in the host diet. Similarly, tumor-bearing mice were held on isocaloric-synthetic diets in an effort to determine the effects on tumor growth of protein-free, fat-free, and carbohydrate-free diets. It is possible that the source of calories (whether from protein, fat, or carbohydrate) or the percentage distribution thereof, may be of importance in establishing tumor inhibition.

Data were presented showing composition of diets and their antitumor effects in mice bearing Sarcoma 180 and Adenocarcinoma 755.

Growth Distribution and Yield of Some Common Bermudagrass Ecotypes Collected in Alabama

C. S. Hoveland
Auburn University

Common bermudagrass (*Cynodon dactylon*) ecotypes were collected from 11 locations in Alabama, planted at Auburn along with Coastal bermuda, and clipped monthly to obtain forage yields

during a 3-year period. In another experiment three high yielding Alabama common bermuda ecotypes were compared with common bermuda from Arizona-grown seed. Large differences in total yield and seasonal distribution of forage were shown by the ecotypes. Certain ecotypes produced more than twice as much forage during the spring period as did several of the least productive ecotypes. Several ecotypes made more early spring growth than common bermuda grown from Arizona seed or Coastal bermuda.

The highest-yielding and earliest of the 11 bermuda ecotypes tested at Auburn generally came from fields with well-drained soils.

Fishes of the River Styx

A. F. Hemphill
Spring Hill College

Since August, 1956, 2,246 specimens of fishes representing 11 families, 19 genera, and 30 species have been collected from the Styx River, Baldwin County, Alabama. Relative abundance of various species was discussed.

Relation of Pecan Scab Control to Nut Quality in Alabama in 1961

Urban L. Diener
Auburn University

Alabama pecan growers have averaged a 4.4 million dollar annual income during the past 10 years, with a high of 10 million dollars in 1958. Pecan scab, caused by *Fusicladium effusum* Wint., is a limiting factor in pecan production even with improved varieties.

The relation of nut quality to disease control was evaluated in a grower-cooperator experiment in Baldwin County, using an air-blast sprayer to apply dodine (Cyprex), zineb (Dithane Z-78, Parzate), and ziram (Zerlate) to 16-year-old Success pecan trees. Eight applications were made at about 3-week intervals from April 28 to August 30.

Scab index ratings were calculated from data taken from green nuts graded according to the degree of husk infection. The ratings were: **0**, no scab; **1**, trace to 10%; **2**, 11 to 25%; **3**, 26 to

50%; and 4, 51 to 100%. Nuts at harvest were weighed and cracked, and data were taken for quality of meat and price offered by a commercial sheller. Data were summarized as means for 10 replications for each treatment.

Disease index ratings showed that dodine (½ to 1 lb./100 gal. of spray) gave excellent disease control as indicated by 88-89% of the nuts having from 0 to 10% of the husk surface scabbed. Zineb (2 lb./100 gal.) gave good disease control with 58.8% of the nuts in the 0-10% classes. Control with ziram (2 lb./100 gal.) was poor. Ziram treatment and the check had 6.2 and 4.8% of the nuts, respectively, in the 0-10% classes. Disease observations estimated little or no premature drop of nuts from scab for the dodine and zineb treatments. Drop for ziram and the check were estimated at 10 and 30%, respectively.

Nut quality data from harvested nuts showed the same general trend between treatments and check as the disease data. Nuts from dodine treatments were slightly better than those from zineb- and ziram-treated trees, and were distinctly better than the check in having fewer nuts and fewer culls per pound, which indicates heavier and well-filled nuts. Also, dodine-treated nuts had a higher per cent by weight of total meats and No. 1 meats and a lower per cent of ambers than nuts from check trees. Price differential between the check and sprayed pecans varied from 2-4¢ per pound more for the sprayed nuts.

Gymnema Sylvestre And Taste Studies

Kamal Yackzan
Alabama College

An examination of the physiochemical properties of the leaves of the plant *Gymnema sylvestre* was performed. The method of testing comprised qualitative, semi-quantitative, electrophysiological, and psychophysical analyses. The leaves contain a drug or an active principle which had been known to suppress the human's and the animal's sensitivity to sweet taste qualities. This active principle was usually located in the crude aggregate of substances which was precipitated by a mineral acid from a solution containing leaf extract. Qualitative testing, utilizing chemical and molecular spectroscopic analyses, showed that the active principle contains aromatic nuclei which corresponded to anthraquinone and

pyrone derivatives. Electrophysiological analyses revealed that the suppression effect on the hamster affects four basic taste qualities. Quantitative data on sugar response revealed that the affinity between sugar molecules and taste receptor decreased. The mechanism of action appeared to be a general one involving an alteration in the receptor surface and the existing electrolyte film surrounding it such as saliva or water. It may be possible that the interaction involved the water of the membrane as judged by the astringency and drying effect of the drug. The recovery of the taste receptor indicated a reversible mechanism. For the human this suppression amounted to a change of threshold by a factor of about 5, in 50% of the subjects' responses. Recovery from the suppression was enhanced by repeated rinse of the mouth with taste solution and water. The magnitude of suppression after a certain minimal concentration seemed to be independent of the number of leaves used or their total content of the active principle. The drug was also present in the leaf extract and in the foam obtained from it.

Age-Size Correlation of Over-Story Trees in Two Longleaf Pine Forests

C. M. Farmer
Troy State College

In two longleaf pine forests, one apparently burned within a year and the other unburned for four or five years, there was noticable difference in the size of the trees. There were fewer and smaller trees in the burned forest than in the unburned. The reason for this was not apparent.

Ten 100-square meter plats were laid out in each forest and the diameters and ages of a sampling of the over-story trees were determined. The average age of fifteen sample trees in the unburned forest was 43.5 years, while that of ten samples in the burned forest was 43 years. The average diameter of the sample trees in the unburned forest was 8.98 inches; that of the burned forest was 8.18 inches, a difference of .8 inches.

The average breast-high cross-section area for the unburned forest was 63.33 square inches; that of the burned area 52.51 square inches, a difference of 10.82 square inches in favor of the unburned forest.

This difference in size of trees in the two forests could hardly be attributed to burning as both forests had been burned, probably annually, until the last four or five years.

Crowding could not have caused the difference as neither forest was crowded and there were decidedly fewer trees per unit area in the burned forest.

Samples of soil were taken with a soil auger and revealed a hard-pan of sandstone about 18 inches from the surface in the burned forest. It was seen by digging down by a young pine that the roots, on coming in contact with the hardpan, did not penetrate it but became lateral.

Borings in the soil of the unburned forest showed no hardpan, but a considerable amount and depth of clay in the subsoil.

Here is an explanation for the difference in size of the trees in the two forests. The hardpan being impenetrable to most or all roots limits them to space near the surface. It was also impervious to water, limiting the moisture supply and causing much quicker and greater effects of dry weather. If, as generally conceded, moisture is an important factor in the growth of longleaf pine, the hardpan would have a detrimental effect on the growth of the trees.

This study indicated that hardpan may be an important factor in the size of trees of the same age in otherwise comparable forests.

Anabolic Steroids and Avian Growth

J. R. Howes
Auburn University

Promotion of nitrogen retention and muscle protein synthesis by androgenic steroids is associated with undesirable effects. Several anabolic steroids have been developed recently and clinically accepted. An investigation of the possibilities of these compounds for avian growth appeared desirable, especially since the poultry industry may no longer use stilbestrol.

Three anabolic steroids have been evaluated in a series of experiments over the past two years using vent-sexed Arbor Acres strain broiler chicks raised to eight weeks of age. These three compounds were Methandrostenolone, 17 Ethyl-19 Nortestosterone, and 9 Fluoro-17 Methyl Androstene -11 -17 -Diol-3-one. All stimu-

lated growth in both males and females raised on wire, but failed to boost growth with birds raised on wood-shavings litter. Studies to date indicated this difference in response to be a complex problem.

All three steroids promoted growth better at lower dietary levels, but 0.25 mg./lb. feed has been found to be most practical. Other tests indicated that these compounds were more effective with lower levels of dietary protein. In an experiment where an anabolic steroid was fed with and without graded I. M. injections of crude avian pituitary extract, growth stimulation occurred in both treatments but the effect was not additive.

The Composition and Production of Avian Dust

J. Koon, W. Grub, and J. R. Howes
Auburn University

With the increasing use of controlled environments for raising poultry, the engineering problem of eliminating poultry dust becomes acute. Certain biological information about the production and composition of avian dust is needed apart from the possibilities of reducing poultry dust by biological means.

In the Auburn environmental chambers quantitative dust collections were made for both caged laying hens and growing chicks of different ages which were raised on shavings litter. The amount of dust produced by caged hens decreased with increasing environmental temperature and contained approximately 60 percent protein and 10 percent fat. Microscopic examination revealed that the hen dust consisted largely of skin and feather debris together with some dust from the pelleted feed. Long feather fibrils to which epidermal material adhered formed a mat on the filters which had to be removed frequently by vacuum.

Dust produced by the growing chicks also decreased with increasing environmental temperature. The amount of dust increased rapidly up to the age of five weeks by which time the chicks had feathered. The more variable chick dust contained less fat and more protein than the hen dust which might be expected since it contained less skin and more feather debris.

It was discovered that avian dust accumulated on the heating coils of the heat pumps in the environmental chambers during

hot weather. When these coils began to heat during cold weather this dust smouldered, giving off a toxic gas. The sensitive respiratory system of the bird quickly responded to the unknown poison exhibiting anoxia, cyanosis and sudden death. Post-mortem examination revealed pulmonary and coronary congestion. The toxic principle is being investigated.

Effects of Radiation on the Photoperiodism of *Portulaca smallii*

David J. Cotter
Alabama College

Previous detailed study on the ecological life history of *Portulaca smallii* (Cotter, 1959) revealed the importance of light in its environmental responses. *P. smallii's* habitats on the granite outcrops in Georgia are characterized by a low grade uranophane, which gives a chronic low level radiation to these plants. This study was undertaken to ascertain the effect of radiation on the photoperiodism of *P. smallii.*

Plants were exposed to radiation in the Cobalt field at Emory University. Six radiation treatments were given to the plants: 1,000r, 5,000r, 15,000r at three dose rates, and 30,000r. These plants with appropriate controls were divided into two groups, one exposed to the natural photoperiod of about 14 hours, and the other limited to a 10 hour photoperiod which approximates the maximum induction period. Increased radiation was found to decrease the total size, number of leaves, branches and reproductive units, and seeds within both experimental groups. The difference in photoperiod response remained evident in all groups except at the 30,000r level which killed most plants before differences could be noted.

Influence of Calcium and Strontium Upon Growth and Development of Two Aquatic Phycomycetes

Patricia M. Meller and Joseph C. O'Kelley
University of Alabama

The experimental results indicate that *Saprolegnia* sp. requires an alkaline medium for growth, and that its growth is inhibited by strontium when calcium is scarce. *Achlya klebsiana* grows well

in Ingraham and Emerson's calcium-containing *Allomyces* medium adjusted to pH 5.3-6.5. A calcium requirement exists; mycelial mats produced in this medium can be induced to form zoosporangia and release zoospores within 20 hr after being placed in distilled water. Normal growth and production of motile zoospores is dependent upon the presence of calcium. Aberrant growth occurs in calcium-deficient media, when the calcium is replaced by either sodium or strontium. Mycelial mats produced without calcium were very small and the hyphae demonstrated unnatural branching; zoospore production could not be induced. The optimum medium calcium level for growth of *A. klebsiana* in Ingraham and Emerson's medium is that provided by 8 mg/1 $CaCl_2 \cdot 2H_2O$. This research was supported in part by Grant A-3680 from the National Institute of Arthritic and Metabolic Diseases.

Reproduction and Species Survival in *Croton alabamensis* E. A. Smith ex Chapman, a Shrub Endemic to Alabama

Joe A. Farmer
University of Alabama

Croton alabamensis E. A. Smith ex Chapman, a small semi-evergreen shrub, is found localized in the Cahaba River drainage in Bibb County, Alabama, and the Warrior River drainage in Tuscaloosa County, Alabama. Growing on arid rock outcrops, this species possesses several interesting reproductive adaptations.

Asexual reproduction of this endemic shrub does not occur naturally.

Several features of characteristic behavior and structure in sexual reproduction are apparently critical to survival. Seasonal timing of the flowering and fruiting processes is correlated with favorable temperature and moisture in the habitat. The nature of pollination, heavy yearly fruiting, nature of seeds, and seed dispersal means are ostensibly related to habitat. Also, timely dormancy of various stages in the life cycle favors survival.

Inhibition of Growth of Sensitive and 6-Mercaptopurine-resistant Mammalian Cells by 9-Alkylpurines

Doris J. Adamson, G. G. Kelley, Ellen P. Horton,
and Margaret H. Vail
Southern Research Institute

A number of 9-substituted derivatives of 6-mercaptopurine (MP), hypoxanthine, adenine, and 6-chloropurine have been found to inhibit growth of cell culture of a human epidermoid carcinoma, H.Ep.#2, and two sublines resistant to MP. The data from this study indicated that the butyl, pentyl, cyclopentyl, hexyl, cyclohexyl, heptyl, and octyl derivatives of these purines were inhibitory to the sensitive and resistant cells. The data further indicated that the 9-alkylpurine derivatives inhibited one of the two resistant lines (MP-1) to a greater degree than the other. Additionally, both resistant lines were more sensitive to the shorter chain normal alkyl derivatives and all of the cyclohexyl derivatives than was the parent line. However, there was little difference in sensitivity between all three lines to the longer chain normal alkyl derivatives.

In an effort to verify and extend these results with other cell lines, two additional MP-resistant lines were obtained. One of the MP-resistant cultures was isolated from a human epidermoid carcinoma, strain KB, and the other was isolated from a murine neoplasm Adenocarcinoma 755.

The results of experiments evaluating the 9-alkylpurines using the KB/MP and Ca755/MP resistant lines indicated that the cells were not inhibited by MP substituted at the 9-position with the cycloalkyl groups but were inhibited by MP substituted at the 9-position with normal alkyl groups; however, the concentration required for inhibition was four to eight times greater than the amount required for inhibition of the H.Ep.#2 resistant lines.

The Construction and Application of a Simple and Economical Electrocardiograph

J. K. Pruett
Auburn University

This project was undertaken to design an inexpensive electrocardiograph. The instrument designed is capable of reproducing a typical PQRST pattern which can be viewed on an oscilloscope,

heard by means of a speaker or recorded on a kymograph drum or on any other suitable recorder.

The main unit of the instrument is a twelve watt high-fidelity amplifier. Stray signals that are encountered are filtered out with a series of low pass filters. The recording pen driver is made from the voice coil of an inexpensive speaker.

The instrument has been used successfully on rodents, reptiles and humans.

Incidence and Control of Peanut Leafspot

J. A. Lyle
Auburn University

Two major types of leafspot diseases are recognized as common on peanuts in southeastern United States. Each is caused by a different species of the *Cercospora* fungus, *Cercospora arachidicola* and *Cercospora personata*. The effects resulting from infection by these two fungi are regarded, however, as only one disease. In addition to leafspots, lesions occur on stems, petioles, and seed pods. Further spread of infection can cause peg breaking and severe early defoliation of plants. Evidence of peanut leafspot infection will not be visible for at least three weeks after the fungus has entered the leaf. Once the leafspot organism enters the leaf it cannot be killed; therefore, leaves should be coated with a fungicide.

In the last three years leafspot incidence has been determined from plants growing in experimental plots. One hundred leaves were obtained at random from each disease-control plot on the tenth day after the last fungicidal application and two weeks prior to harvest. Data from these experiments have shown losses in yield associated with high leafspot incidence. In addition, spore traps were placed in and adjacent to peanut fields to determine the time of spore dissemination. The most abundant spore dissemination occurred during the period of July 12 to July 28 each year.

Control measures seem equally effective on both organisms. Applications of fungicides were made during the first part of July, with four applications being made at 10- to 14-day intervals. By following this schedule, the last application was made about a month before harvest. Copper-sulfur dust applied at the rate of

25 lb. per acre; and maneb and Tennessee Copper-90 sprays applied at the rate of 2 lb. and 2 gal. per acre, respectively, were more effective than other fungicidal materials for disease control. Effective control of peanut leafspot, either by dust or spray fungicides, has materially increased the yield of nuts and the quality of peanut hay. Furthermore, leafspot control reduces defoliation, and, thus, prevents a buildup of organic matter upon which inoculum of other pathogenic fungi can be produced.

Use of Plant-Growth Regulators in a Basal Medium for Isolating Soil Fungi

E. A. Curl
Auburn University

Efforts are continually being made to develop a superior cultural medium for isolating fungi from soil. The commonly used peptone-dextrose agar with rose bengal and streptomycin is good; however, many workers believe that rose bengal, while fulfilling its purpose of retarding rapidly spreading fungi in dilution plates, may prevent slowly growing fungi from appearing.

During the period 1958-1960, more than 35 dyes, alkaloids, plant-growth regulators, and miscellaneous chemicals were tested at various concentrations as substitutes for rose bengal in a basal medium of peptone-dextrose agar containing 30 ug/ml of streptomycin sulfate. Initial tests indicated that indole-3-acetic acid, 2,4-dichlorophenoxyacetic acid, and 2,4,5-trichlorophenoxyacetic acid were superior to rose bengal. However, repeated testing in 1961 proved these materials to be inconsistent, and in general, they were not better than rose bengal.

Recently three new plant-growth retardants were included in the testing program. They were: 2,4-dichlorobenzyltributyl phosphonium chloride (Phosfon); 2-isopropyl-4-dimethylamino-5-methylphenyl-1-piperidine-carboxylate methyl chloride (Amo-1618); and 2-chloroethyltrimethyl-amonium chloride (CCC). Amo-1618 and CCC were unsatisfactory at the concentrations tested for isolating soil fungi. Phosfon, however, at a concentration of 500 ppm allowed consistently more fungal colonies per plate than did rose bengal, and it satisfactorily controlled growth of species of *Mucor*, *Trichoderma*, and other rapidly spreading fungi. A mixture of

Phosfon and Gibrel (potassium salt of gibberellic acid) was equally as good as Phosfon alone, while Gibrel alone was completely unsatisfactory.

Serotonin and Gastric Motility: a Preliminary Report

Rebecca Ingle and Kenneth Ottis
Auburn University

Thirty-six 220-230-gram healthy 3-month old white rats of the Holtzman strain were used in this preliminary experiment to determine the effect of serotonin upon gastric motility and to correlate enterochromaffin cell activity with the activity of the intestine of the reserpinized animal.

The animals were divided into two groups. The animals of Group I received a dose of 1 mg. of reserpine per kilogram of body weight intraperitoneally for three consecutive days. The animals were sacrificed, the duodenum removed, placed in a perfusing apparatus and Kymograph records made of the motility. A section of the duodenum was fixed in formalin and embedded in paraffin for histochemical study. The animals of Group II received Marsilid at the dosage rate of 50 mg. per 100 grams of body weight intraperitoneally. An hour later they received reserpine at the same rate as described for Group I. The animals were sacrificed at hour intervals, motility records taken, and a section removed for future histochemical study. Controls were run with both groups.

1. The gastric motility records of the experimental animals of Group I, when compared to that of controls, showed a marked increase in the height of contraction waves.

2. The motility records of the Marsilid-treated animals showed an even greater increase in height of contractile waves, and an increase was noted in the number of contractions. The greatest increase was seen in those animals sacrificed five hours following the reserpine injection.

Section IV—Forestry, Geography and Conservation

Droughts in Alabama

Arthur R. Long
U. S. Weather Bureau

Drought was defined. Brief accounts were given of some notable Alabama droughts from 1825 through 1954. Questions as to why droughts occur, and the prevention of droughts were briefly considered. Also, a brief summary was given on the subject "Can droughts be forecast?"

Sumter County, Leader in Alabama's Beef Economy

Hazel L. Stickney
Livingston State College

In general, the southwestern half of Sumter County, with its coastal plain and acid post-oak soils, has smaller farms and a larger percentage of white population than the northern prairie. Some sections of this area were never cleared of their post-oak and flatwood forest, and since the beginning of the current century the sections of the area which had fine stands of virgin timber have been bought by lumber companies. During the period from 1930 to the present, paper manufacturers have been buying land in this section also. Both lumber and pulpwood production have increased in southern Sumter as cotton acreage has been reduced and lands have reverted to pine growth.

The northern portion of the county, with its lime and post-oak soils, has large farms and a dense Negro population inherited from cotton days, though the number of Negro tenants and sharecroppers is steadily diminishing. This section, stimulated by numerous factors, has been changing to pasture acreage and beef production during the past 50 years, though the tempo of change has increased since 1930. This trend, together with mechanization, has changed the landscape of the prairie and the outlook of its population.

The Development and Use of Fire Danger Ratings in The Control of Forest Fire

C. F. Attaway
Alabama Department of Conservation

Fire danger is a general term expressing the sum total of both the constant and the variable factors which determine the probability of fire occurrence, its rate of spread and its resistance to control. The first numerical system of measuring and rating fire danger was developed and put into use in 1930 as the result of a research project initiated in 1922. The danger factors usually measured are rainfall, wind, fuel moisture and condition of vegetation. Measurements of these factors are resolved into numerical fire danger classes or index number by means of a danger meter.

Fire danger ratings expressed as index numbers mean nothing in themselves, but when summed, averaged, compared and correlated with many factors influencing fire behavior they have meaning and provide a valuable tool for use in fire control.

Fire danger ratings are useful in the prevention, presuppression and suppression phases of fire control and in appraising fire damage.

Additional developments can be expected in the field of fire danger rating. Many problems remain unsolved and often too much is expected of burning index rating in their present form. Their meaning in different situations must largely be determined by experience.

Fire danger ratings meet a definite need in the control of forest fires and represent a tremendous advantage over the informal method of guessing at fire danger, common some twenty-five years ago. They aid but do not replace experienced judgement.

An Analysis of the Legislative Effort of the Federal Congress in Behalf of Forests and Forest Lands in the Period 1950-1955

Robert J. James
Auburn University

Federal legislative efforts in behalf of forests and forest lands during the period 1950-1955 may be analyzed considering three major factors which influenced Congress during this time. First was the economic situation. The nation was still adjusting from the wartime economy of World War II and had suffered a recession in 1949.

Second was the Korean Conflict to which Congress put most of its effort in the early years. The third factor was the 1952 change from Democratic to Republican Administration. The new Republican Administration desired to reduce the existing level of government spending.

Legislative efforts of the federal congress can be divided essentially into two categories—funds for programs, and acts and endorsements. Appropriation of funds for programs concerning forests and forest lands rose and fell during the early years of this period, then leveled off in 1953 and 1954. In 1955 appropriations rose to a new high through the efforts of the Senate in the face of a "cut the budget" administration.

During this period the Cooperative Forest Management Act, the Granger-Thye Act, and Public Law 46 were passed to expand and strengthen federal-state cooperative activities and assistance to private forest land owners. A revision of the Federal-Aid Highway Act made possible the appropriation of funds for the construction of forest access roads. Revision of the Federal Reserve Act and the Internal Revenue Code encouraged ownership and development of forest lands. Abuses to forests on unpatented mining claims were stopped by a law passed during this period, and the dispute over the administration and management of the Oregon and California railroad lands was settled.

Considering the economic, social, and political obstacles characterizing this period, reasonable progress was made in federal legislation on behalf of forests and forest lands.

An Analysis of the Legislative Effort of the Federal Congress in Behalf of Forests and Forest Lands, 1955-1960

Richard A. Mills
Auburn University

From 1955 to 1960, 244 bills were introduced into Congress concerning forestry and forest lands, but only 6 of these bills were finally passed to become public laws.

There are several reasons why so few forestry bills passed in relation to the large number introduced. Many of the bills introduced were relatively minor or unimportant legislation lacking the support necessary to pass through Congress. In most instances two or more bills were introduced concerning the same subject, the passage of any one of these bills precluding the need for the others. Many

bills which were not passed during one Congress were reintroduced as new bills in each succeeding Congress.

The six forestry bills passed during 1955-60 were: two bills authorizing additions to the national forests; a bill making all national forest land subject to the Week's Law; a bill authorizing acquisition of private lands for rights of way to public timber; a bill limiting commercial leasing of national forest lands; a bill authorizing that the national forests be managed under multiple use—sustained yield principles.

Relative support and opposition determined the outcome of all bills introduced during this period. For a forestry bill to pass successfully by Congress and become a law it had to be supported, not only by its initial sponsors but also by key members of Congress, by national organizations, by the federal agencies which it affected. Most important of all, it had to be approved and reported out by the Congressional committee to which it had been referred.

Section V—Physics and Mathematics

The Design, Theory, and Experimental Application of a Proportional Counter

Chris Patte
University of Alabama

The history of atomic counters was briefly examined. Their characteristics and principles of operation are discussed with emphasis on the inter-relationships of counting regions: a) Recombination, b) Ionization, c) Proportional, d) Limited Proportionality, e) Geiger, and f) Continuous Discharge.

The theory of pulse formation was then discussed together with an examination of A, the gas amplification factor. The limits on A were discussed together with its influencing factors.

The construction of the apparatus was explained together with a description of the electronic circuits involved.

A description was given of counter operating procedures and a discussion on spectral analysis was given for a typical counting operation. Calibration techniques of the counter were explained and several typical graphs were shown. Optimum conditions were given for certain calibration curves and the parameters involved (voltage, gas pressure, and gas mixture) were discussed.

The normal background noise of the counter was discussed together with a statement as to its probable cause, cosmic rays. The origin of these rays was briefly discussed, as well as their types and energies.

A closing statement was made as to the contemplated use of the proportional counter by the University of Alabama.

A Comparison of High School and College Mathematics Grades

Rev. W. L. Furman, S. J.
Spring Hill College

A comparison of high school and college grades on mathematics was made and close agreement found. The students studied were Jesuit scholastics at St. Charles College, Grand Coteau, Louisiana. In their curriculum no course in mathematics was taken during the first two years at the college. In the summer session after the second year, college algebra was taken and during the summer session after the third year a combined course in analytic geometry and calculus was taken. This curriculum in mathematics has been followed for several years regardless of high school preparation in mathematics. The study indicates that a high correlation exists between success in high school mathematics and success in college mathematics.

Hysteresis Experiments in the Intermediate Electricity and Magnetism Laboratory

Thomas I. Hicks
Howard College

An experiment commonly performed in the intermediate level electricity and magnetism laboratory is the study of the hysteresis of ferro-magnetic materials. Consideration is given to three means of observing ferro-magnetic hysteresis, the Rowland ring with ballistic galvanometer, the traction permeameter, an an AC method using an intergrator and a CRO, noting the advantages and disadvantages of each as they apply to the needs of the student and to the teaching value of the work.

Special attention was given to using a cathode-ray oscilloscope for direct observation of hysteresis whereby a student can thus see immediately the results of his experiment. Further, this method provides a student an opportunity to use techniques and equipment

commonly employed in the modern laboratories. Traces of hysteresis loops of specimens were included to illustrate the comparison between samples and the frequency response of samples which the student can readily make.

Apparatus for Observing Mossbauer Effect

K. F. Suen
Auburn University

The gamma detecting device uses NaI scintillation. It consists of a photomultiplier tube with NaI crystal, amplifier, and a single channel analyzer that enables us to select the gamma energy level of our interest. A wide range of adjustably uniform velocities (0-1.0 cm/sec) for Doppler shift is provided by a pneumatic hydraulic system (above the region of 1 cm/sec, the velocity may not be uniform). Sets of microswitches are used to shift the relay, so that the gamma counts are recorded in one or the other scaler according to the direction of motion. Exact operating-time for each gamma scaler is given by a modified 60 cps time scaler. Knowing the distance of travel, the velocity can be determined. Reverse motion microswitches are set at considerable distance from the previously mentioned microswitches so as to eliminate the non-uniform velocity regions at the extremities of travel.

Further X-Ray Studies of Eggshell Crystal Structure

Charles J. Cain
Auburn University

Earlier studies of the crystal structure of some avian eggshells using x-ray diffraction techniques have been continued. Previous observation indicated that the avian eggshell is chiefly composed of the calcite form of calcium carbonate. The size of these calcite crystals has been determined by Clark's method involving a comparison of the eggshell diffraction pattern with similar patterns obtained from various samples of ground calcite; the large size of the crystals is probably responsible for the asterism noted in earlier patterns. A curved-crystal focusing monochromator has been employed to detect the presence of lattice distortion due to strain in the eggshell. The orientation of the crystallites has been determined and an attempt has been made to construct a model of the eggshell which will produce the observed diffraction patterns.

Sub-Millimeter Radiation from a Relativistic Electron Beam

William H. Venable, Jr.
University of Alabama

In connection with the design of apparatus to produce submillimeter radiation, a study was made on the feasibility of confining slow surface waves in a cylindrical waveguide with a corrugated inner surface. The field equations derived in this study are in full agreement with the equations already at hand for flat, finely corrugated surfaces such as diffraction gratings on one extreme and the disc loaded waveguide used in linear accelerators on the other. The study indicates that the best chance of success in designing slow wave structures lies in using 2 (2q+1) corrugations per wavelength in the first extreme mentioned above and 4q corrugations per wavelength in the second (q is a natural number). The conditions under which the transition from one structure to the other should be made is given by the theory.

Calculation and Use of an Exact Potential Function for Electron Scattering from Cesium

W. Ray Garrett and R. A. Mann
University of Alabama

Hartree wave functions for the cesium atom are used to obtain an exact potential function for electron scattering at low energies. The Schroedinger equation is then solved with this potential and for free waves thus allowing the phase shifts to be obtained directly. These phase shifts are then used to obtain scattering cross sections very accurately for low incident energies.

Theoretical Study of Atomic Scattering

Karl R. Klose and R. A. Mann
University of Alabama

The analytic formulas for atomic scattering are derived from basic considerations. Numerical calculations for electron scattering from atomic cesium are made for incident energies between 1 ev and 10 kev. The atomic scattering factor is calculated using numerical Hartree wave functions. The angular distribution and total cross section are then calculated and plotted.

Section VIII—Social Sciences

Max Weber, A Socrates for the Social Sciences

Richard M. Owsley
Auburn University

The social or the behaviorial sciences are the last of the human disciplines to achieve a unified program of development. The physical sciences and the biological sciences have long since agreed upon certain basic principles, accepted definite methods of procedure, and have formulated stable attitudes toward their own limitations. Even the humanities have accepted certain universal canons of scholarship and criticism. It is the contention of this paper that similar unification in the social disciplines can best take place through focusing upon one personality. Just as Galileo is to physics, Darwin is to biology, and Socrates is to philosophy there may be some one figure around which all investigators in the social disciplines can unite. This suggestion has some advantages over the direct attempt to find an acceptable credo or a single methodological basis. It is the further contention of this paper that a strong candidate for this pivotal role is Max Weber. Weber can be viewed as the Socrates of the social disciplines in that he attempted to give sociology, history, and economics a goal, a plan of attack, and a criterion of accomplishment. His attempts were, in a sense, a failure and yet they were failures only in the sense that Socrates' clarifications were failures. As with the great philosopher, Weber can, and perhaps should become the model of the investigator of man.

The Financial Institutions Excise Tax in Alabama

Arnold L. Barrett
University of Alabama

In 1868 Congress enacted Section 5219 (U.S.R.S.) for the purpose of preventing the states from taxing national banks on any other than a fair and equal basis with state banks. This applied to both real estate and shares of national banks. Until 1921 the federal courts generally construed the act to be confined to the area of banking, national and state. Due to certain discriminatory practices by such states as Wisconsin and Virginia, the courts broadened the coverage to include all moneyed capital coming into direct competition with national banks.

Through a series of court decisions on, and amendments to "Section 5219," four alternative methods for taxing financial companies came into being by 1926. In addition to the traditional real estate tax, left undisturbed, states could tax all financial business *equally* with a dividend tax, or a shares tax, or an income tax, or an excise tax "measured by" income. The excise method opened the way of taxing even the income received on tax exempt government securities. Alabama adopted the excise method in 1932, and in 1933 a new act was passed which exempted no sources of income from the base.

In 1935 the rate was raised from five to six percent of net income. With exception of minor fees and local real estate taxes, the excise levy just about covers the taxes paid by financial institutions. (Mutuals may deduct dividends paid out in computing their bases.) Tax receipts are shared by the state with cities and counties where institutions are domiciled. Although ordinary business corporations pay on income at three percent, they are subject to other taxes from which financial institutions are exempt due to their higher rate.

The excise tax has been soundly conceived and administered in Alabama. It has not been a very productive tax in the State revenue system. But financial business, though more secure, is generally not as profitable as many other types of business, and the low aggregate yield indicates a dearth of financial capital in the State.

Some Reflections on American Capitalism

E. D. Chastain, Jr.
Auburn University

The economic literacy of American citizens has received renewed attention from several directions in recent months. The need for general economic education of the masses is not a matter for denial. Relative to economic systems, the American tendency has been to place emphasis on understanding of non-capitalistic economies. An appreciation of the attributes of the economic system in which one resides, as well as alternative systems, is required for an informed citizenry of any country.

Evidences of the lack of knowledge regarding the economic system of the United States suggest that increased emphasis should be placed on aggregate understanding of the attributes of the system. Problems of semantics can and should be eliminated. The ful-

fillment of these needs entail exposure of the populace to that which is known in economics and exposure under competent instruction. "There is a tremendous gap between what is known in economics and the economics known and accepted by the general public."—Bottum.

Distinction between economic systems requires expression of ownership, use, and control of the means of production. An evaluation of the system requires consideration of the status of economic progress (including agricultural as well as industrial progress), income distribution, economic fluctuations, and degree of individual freedom. An examination of the present knowledge regarding these four criteria discloses that American capitalism is defensible and that it can survive, contrary to the prediction of Schumpeter (*Capitalism, Socialism, and Democracy*).

Elementary Thinking and Perceptual Learning

A Further Discussion of "A Behavioral Model for Ontogeny"

Eleazer C. Overton, O.D. and Glen W. Herren, O.D.
Birmingham, Alabama

In this paper, reference is made to a previous paper read before the Social Science Section at the 38th Annual meeting entitled "A Behavioral Model for Ontogeny" in which the holistic concept in biology was proposed for a more unified theory in the life process. It was pointed out that the dualistic concepts that had arisen in the development of scientific thought had produced a paradox, (i.e. mind and body, spiritual and material, matter and energy, living and inert, etc.) that hampered inter-professional communications and the development of better clinical methods for those disciplines dealing with the life sciences. A theory is outlined supporting this thesis.

The present paper extends the theory of the first by making practical application of its concept in the development of mental functions.

Energy is treated as the basic universal assumption with the principle of continuity, entropy, communication—information theory utilized to demonstrate the "structure" of inorganic as well as organic systems. It is pointed out that emergent characteristics evolve as the result of more complex bonded energy systems; this gives rise to consciousness and intelligent forms in the course of cosmic evolution.

"Intelligence" then becomes identified with *controlled probability* in energy systems. These systems become "self-determinable" through *information retrieval.* It is further pointed out that the organic sequence, stimulus—conduction—response, elaborates the distribution of energy (entropy) as well as "time-bind" (learn) sequences of events. Indeed, "time-binding" is the unique characteristic of organic systems including man. Mind and perceptual activity in human forms are the emergent result of phylogeny. Ontogeny would seem to repeat phylogeny and the premise for our model for onotogeny would naturally be found in the mechanics of evolution. This notion is carried out in the development of elementary thinking and perpetual learning. References are cited lending support to this theory.

Factors Affecting the Solution of Community Problems

John H. Carr
Birmingham, Alabama

Community organization has been described as "the definition and measurement of major health and welfare problems, the understanding of causative factors, the establishment of goals based upon needs and existing resources, and the development of a constructive program of community services to move toward these goals. Emphasis is thus placed upon concern for major community problems, upon research and finally, implementation." The major function of community organization is then one of solving problems. Focus of the paper was on some of the causative factors which must be recognized and dealt with if the community organization practitioner is to be effective in finding solutions to community problems.

The experience of Birmingham and Jefferson County in establishing their Surplus Food Program in 1961 seemed to be an excellent example which could be used to illustrate the many factors which must be considered and understood if problems are to be solved.

The Jefferson County Coordinating Council of Social Forces is the agency responsible for planning in the field of health, welfare and recreation. Although this agency is primarily supported by Community Chest funds, its area of concern encompasses both public, tax supported and private, voluntary agencies in the three areas mentioned above.

The Coordinating Council at the request of the AFL-CIO Labor Council undertook a study to determine the need for a Surplus Food Program in Jefferson County. Research disclosed a definite need for the program and the Coordinating Council then proceeded to develop a plan outlining how the program should be administered and financed.

The following factors influenced the manner in which this particular problem was solved. Many of these same factors will be encountered in the attempt to solve a community problem of any magnitude.

1. Attitude of the community and public officials toward special interest groups.
2. The influence that past community experience has on current planning.
3. Sound research of a community problem without proper interpretation and public support usually results in no action being taken.
4. The political climate of a community has a definite effect on the attitude of the public, public officials and the news media.
5. Conflict from self-interest can block or delay community action
6. Timing is an important factor to be considered in attempting to solve community problems.
7. Political expediency and racial prejudice can both influence how a community attempts to solve its problems.

The Psychology of Teaching Reading

Frederick L. Westover
College of Education, University of Alabama

A. The Psychology of Reading

1. *Reading is a mental process,* i.e., it is a process making use of signs or symbols which stand for other things. The symbols are written or printed words and the things for which they stand are their meanings.
2. *Reading is preceded by speech.* In speech auditory symbols called words stand for the things which the words represent. In reading the child learns the written or printed pattern that represents the auditory word with whose meaning he is already familiar.

3. *In the initial stages of learning to read the child reads orally,* but, with practice, he learns to recognize words quickly without saying them aloud, i. e., he learns to read silently, to think the meaning of words from perception of their visual patterns without first having to say them to himself.
4. *The reader and the writer must share a common vocabulary* in order for communication to take place. The author can only suggest through his words what he wishes to convey. The meaning must come from the reader's experience.

B. The Major Skills in Learning to Read

From the above analysis five fundamental skills were suggested as necessary in learning to read.

1. Ten *word-attack skills* may be listed.
   a. Configuration—shape of the word.
   b. Context—usage in sentence.
   c. Basic sight words—most common words.
   d. Phonics or phonetics—self-help sounding.
   e. Inflectional endings, e.g., s, ed, ing.
   f. Common prefixes, e.g., ab, de, un.
   g. Common suffixes, e.g., hood, ness.
   h. Common roots, e.g., bear as in unbearable.
   i. Syllabication, e.g., syl-la-ble.

Skill in using each of these clues in word recognition is emphasized in the elementary grades but continues into the secondary school.

2. *Rapid recognition of words and phrases* is taught by means of flash cards, rapid exposure devices, timed reading exercises, and much reading of easy interesting material.
3. *Skill in comprehension* is taught at the elementary school level by asking at successive stages of development these three questions: (1) What did the author say? (2) What is the main idea? (3) What do you think about it? At the secondary and higher level the SQ4R method of study is often used. These letters stand for (1) Survey, (2) Question, (3) Read, (4) Restate, (5) Repeat, (6) Review.
4. *Vocabulary building* is accomplished mainly through wide reading, but use of the dictionary and study of word lists are also employed.
5. *Rapid reading* is emphasized after the above skills have been acquired. The basic procedure is to give timed exercises with comprehension checks on easy interesting materials and to encourage wide reading.

Reading is a complex skill which children often have difficulty in acquiring, but fortunately, if we apply the psychology of reading, satisfactory results may be obtained except in cases of severe handicapping.

Social and Economic Changes in Sumter County During the 20th Century

Byron B. Williamson, Jr.
Cooperative Extension Service, Auburn University

Sumter County, sometimes called the Gamecock County from General Thomas Sumter ("the Gamecock") of South Carolina for whom it was named, was in 1840 the most populous county of Alabama with nearly 30,000 inhabitants.

It has remained an agricultural county since early times. Even the Choctaw Indians who occupied the area prior to the white man were at least part time farmers producing corn and some other crops to supplement food obtained by hunting.

Scientific farming was, however, a much later development. For generations farmers were generally content to follow the practices of those who farmed before them.

Agricultural societies as early as 1845 did, however, provide a medium for sharing experiences and ideas. Then the Morrill Act of 1862 paved the way for establishing a Land Grant College in the State in 1872 at Auburn. The Hatch Act of 1887 further provided for a beginning of agricultural research, which must be the foundation on which scientific farming rests. The Smith-Lever Act of 1914 then provided for mass spreading to farmers of results of research and provided a further medium through which farmers could exchange information on the results of their methods and practices in farming.

Under this Act and subsequent related legislation Sumter County obtained services of a full-time county agent in 1921, a home demonstration agent in 1928 and an assistant county agent for 4-H Club work in 1930. These public servants were active as educators of adults and youth in improved operation of all phases of farm businesses and operation of homes. Their services have never ceased and in fact have been expanded with passing years.

They have been very instrumental in promoting a major shift from a near all-cotton economy to a diversified and profitable econo-

my which better utilizes farming resources with a far greater emphasis on livestock production and intensified use of land still in cotton and other crops. Acre yields at least of cotton are nearly triple those at the turn of the century. Cattle numbers likewise are over 2.5 times their number in 1900 and are per head much more productive of beef and milk. Operation has shifted much more to actual owners as compared with tenants.

These many changes have promoted the well being of the farmers of the county. Even though farm income possibilities are perhaps less than half realized, the total of farm income of the county had reached 9.5 million dollars in 1960.

The Central American Mission in Central America

Wilkins B. Winn
University of Alabama

The Central American Mission was founded at Dallas, Texas, in November, 1890, by Dr. C. I. Scofield, a Dallas pastor, and three businessmen. Three months later the initial work was established in Costa Rica, and by 1900 it had expanded into El Salvador, Honduras, Guatemala, and Nicaragua. A steady growth resulted from the persistent efforts of the missionaries who endured such hardships as bad health conditions, poor travel facilities, and unsatisfactory housing. Opposition to this ministry assumed such forms as strong ecclesiastical measures of the Roman Catholic Church to suppress Protestantism, annoying disturbances of meetings, and physical violence to both person and property.

Evangelism, stressed from the beginning, utilized regular church services, door to door visitation, and distribution of Bibles and literature. The indigenous principle called for the training of national workers and made necessary the establishment of educational institutions. These efforts produced a relatively new and apparently permanent element in the religious culture of Central America. The work of this Protestant minority group has influenced social and political development by combating illiteracy and by having emphases co-extensive with democratic principles.

The T.V.A. Bill, 1933: Editorial Views of Nashville and Montgomery Newspapers

B. R. Coleman
Troy State College

During the time that elasped between President-elect Roosevelt's pronouncement of a plan for governmental development of Muscle Shoals (Jan. 31, 1933) and President Roosevelt's signing of the Muscle Shoals Act (May 18, 1933), the daily newspapers of Nashville and Montgomery carried on an editorial campaign that generally supported the proposal.

At the time there were three daily newspapers in Nashville—*The Nashville Tennessean, The Evening Tennessean,* and *The Nashville Banner. The Nashville Tennessean* and *The Evening Tennessean* supported the bill with occasional editorials and prominent news stories. Among Nashville papers, *The Nashville Banner* was the champion of Shoals development, running frequent editorials, favorable "letters to the editor," favorable comments from other newspapers from within and without the valley, and prominently displayed news stories.

In Montgomery, *The Advertiser* supported the proposal with only three editorials, but it published favorable reports and by-lined columns. *The Alabama Journal and the Times,* the other Montgomery daily, was the great crusader for Muscle Shoals development. From February 1, until May 19, the *Journal* seldom ran an edition that did not contain a fighting demand for acceptance of the Roosevelt plan. Front page and fourth page editorials, banner headlines, favorable news stories, reprints from sympathetic papers, were all utilized to promote the project. *The Journal* overlooked no opportunity to stress its views. Investigations of power companies, a power bill in the state legislature, statements of power officials, objections of Northern Congressmen, all served as bases from which to launch a new rocket for Muscle Shoals.

The support of the five papers varied only in degree. In attitudes the editorial approaches were similar. All objected to private interest efforts to block the proposal. All commended the project as being of a "new era for the South" which would make the Tennessee Valley the "Ruhr of America." All favored reforestation, improved navigation, flood control and the manufacture of fertilizer, and all hailed the timing as ideal for building hope and beginning the end of depression. All, however, considered the major issue to be power. High power rates, self-interest and callousness of power companies,

the failure of power companies to develop the resources, and other issues were brought into the fight to support Muscle Shoals as a governmental "yardstick" for measuring the real cost of manufacturing and distributing power.

There is no way of determing how such support affected legislation. Probably T.V.A. would have been created without it. But in 1933, the newspapers of the capital cities of Alabama and Tennessee were definitely supporting T.V.A.

An Oligopoly in Action

H. Ellsworth Steele
Auburn University

Many American industries are dominated by a few large firms. In economic terms these industries are oligopolies. Economists stress that in such market situations each firm must temper its own actions by consideration of the expected reactions of its rivals. Baumol has recently suggested that once a given level of profits has been achieved, management of large firms is more interested in maximizing revenues than in adding to profits. He also contends that in making routine decisions management in oligopolistic firms pays little attention to possible repercussions from rivals.

This paper analyzes some aspects of the operations of the major firms which dominate the United States' rubber industry. It concludes that there is vigorous competition among these firms, despite their fewness and the framework of limited cooperation. The paper also concludes that the actions of management in this important industry generally support Baumol's theses.

Spanish Maps: A Tool for the Study of American Colonial History

Alfred B. Thomas
University of Alabama

Spanish map-makers in the New World were trained cartographers, engineers, or sometimes mathematics professors in universities assigned for specific undertakings. In the area of the present United States from Florida to California there is a three century record of Spanish map-making. Outstanding is that of Don Carlos Siguenza y Gongora, who in 1693 drew a detailed map of Pensacola Bay which revealed soundings in all parts of the bay as

well as a careful delineation of the outlines of this body of water and the various rivers entering it. A map with similar significant detail (1705) gave a clear picture of the geography of the Gulf of California and the mouth of the Colorado River.

In the eighteenth century, Spanish authorities ordered general maps of the area from Florida to California. These were based on earlier maps of the preceding two centuries, with details added by first hand observation on the part of the cartographer. Outstanding in this series were the maps of the Chief Engineer of New Spain, Don Francisco Alvarez Barreiro, 1727-1729; that of Engineer Nicolas de la Fora, 1772; and that of Engineers Miguel Costanso and Manuel Mascaro, 1784 (ca). These latter cartographers constructed a huge chart, some eight by nine feet, which shows the territory west of the Mississippi River from northern Colorado and Utah to Central Mexico. Outstanding on this map was the incorporation of Bernardo de Miera's map of present-day central Colorado, and that of Father Francisco Escalante of present eastern Utah and northern New Mexico. California was mapped thoroughly along the coast from Sebestian Vizcaino's thirty-two maps at the beginning of the seventeenth century to the highly detailed maps of Father Pedro Font in 1776.

Maps as a whole have significance in revealing place names no longer present and origin of existing place names, in delineating the first travel routes in the southern area of the United States, and taken together with diaries that usually accompanied the maps, in providing invaluable information on the location and distribution of Indian tribes in the area from Florida to California before the advent of the Anglo-Saxons in 1803.

The Problem of Labor in the Post-Civil War South

Milton M. McPherson
Alabama College

Before the Civil War over 80 per cent of the cotton crop was grown by slave labor. Cotton was not only the chief money crop of the South but furnished 57 per cent of the total exports of the United States in 1860. A speedy restoration of "King Cotton" was therefore of vital concern to both North and South.

Southerners generally believed that the Negro would not work well in freedom. Many planters tried to attract immigrants to the South, but met with little success. The Homestead Act of 1862 made

available millions of acres of nearly free land and many immigrants had only an *Uncle Tom's Cabin* view of the South.

During 1865-1866 most of the Southern planters tried working the freed men for wages. Cotton prices were high and capital was available in sufficient quantity. By 1867 wage labor had practically disappeared because sufficient capital was no longer available, the cotton crops of 1865-1866 had been disappointing ones and because the freed men tended to leave the farm when they were paid wages. These factors made almost inevitable the extension of the share-crop system as the only one that would bind the Negro to the farm until the crop was harvested. Under this system the laborer received a part of the crop, usually one-half, in exchange for the labor of himself and his family. The share-crop system, along with the crop-lien system, by which money could legally be borrowed on a growing or even unplanted crop, helped to bind the South more firmly than ever to a one-crop system.

The production of cotton increased in the South until by 1900 Texas alone grew more cotton than had the entire South in 1860, but this increase was due to white labor. The southern whites, who had in 1860 raised hardly more than 10 per cent of the cotton crop were raising 70 per cent of the crop by 1895. The Negro became less and less significant as an agricultural laborer in the post-Civil War South.

Some Alabama Criticisms of the Second New Deal, 1935-1939

George V. Irons
Howard College

Alabama and the South felt secure in the Roosevelt-Garner combination even though it was a "kangeroo ticket stronger in the hindquarter than in the front."

Most Alabamians were enthusiastic over the legislative output of the "Hundred Days" and the promise of the "more abundant life." For at least two years the basic philosophy of the New Deal was no affront to the tenets of capitalism, and the proposed pattern of the welfare state presented no threat to the sanctity of property.

By 1935, President Roosevelt was compelled to make a fateful choice and to launch a "Second New Deal". This decision was forced by the invalidation of the NRA and the AAA, a growing discontent within the party and the rise of certain liberal and progressive affiliations which threatened the unity of Roosevelt's political combination. Features of the more advanced program were the Na-

tional Labor Relations Act, Social Security Act, the Second AAA, and the Fair Labor Standards Act. The new program was intended to alleviate the miseries of the masses through the most far-reaching economic and social legislation ever undertaken in this country.

This reform plan threatened the political and social structure of the South. The immense federal largesse did not issue from the office of the county judge; "states-rights" seemed nigh to oblivion; the federal wage and hour scale antagonized Alabama industrialists; the wooing of the Negro by the New Deal played hob with "white supremacy".

Southern restlessness and rebellion was followed by unsuccessful attempts to purge the dissidents. Alabama and the South remained in political matrimony with New Deal but affections had been alienated. This political narrative of honeymoon to eternal triangle is related in pungent phrases from newspapers and other sources.

Rural Resource Development

Ralph L. Sherer
Auburn University
Cooperative Extension Service

Economic development has taken place on a national average at a faster rate than in Alabama; yet Alabama is reported as being a state with an abundance of resources, both human and physical. This paper discusses Alabama's resources and some programs designed to help develop the resources.

From 1950 to 1960 the national population increased by more than 18%, while in Alabama the increase was less than 7%. Only six of Alabama's counties had population increases equal or greater than that of national average, and the population decreased in 45 counties. Alabama's farm population decreased by almost 50% during the period.

The educational level of the people of Alabama is lower than that of the national average. This situation is critical as the demand for unskilled is decreasing. The rapid growth segments of the economy demand trained, educated employees.

In 1959-60 a self-analysis was made to determine what the Auburn University Cooperative Extension Service could do to help Alabama realize its full economic potential. The outgrowth of this self-analysis was Alabama's Rural Resource Development Program. The 1961 State Legislature made an appropriation to the Extension

Service for Rural Resource Development work in the state.

The purpose of Rural Resource Development is to find ways to develop more fully and use the resources of the state. It is a means of encouraging and helping people to do what they want to do. The objective is total resource development, with emphasis on industrial as well as agricultural development.

To perpetuate rural development, a Rural Areas Development Committee, or RAD Committee, has been organized in each county as well as 12 area committees. These committees are composed of representatives of state agencies, farm groups, industry, labor groups, county and municipal governments, chamber of commerce, civic clubs and others.

Rural Areas Development is a nation-wide effort supported by the United States Department of Agriculture. Each agency of the Department has been assigned specific responsibilities. In certain badly depressed areas additional help is provided by the Area Redevelopment Administration.

The RAD Committee is concerned with all segments of the economy. It is concerned with agricultural and industrial development, as well as tourism, recreation, health and education, and other interest areas. In a complex society one segment cannot be affected without influencing other segments.

RAD provides the framework for the development of our resources and more rapid development of the economy. But RAD is only a potential. The result will be determined by local people at the local level.

The Economic Adaptability of the Corporate Form of Business Organization to Family Farms

William Fred Woods
Auburn University

The corporation, long used by business and other industry, is beginning to receive considerable attention in agriculture. This attention is because of increasing capital requirements, technical developments, a growing need for more efficient farming and continuity of the business combined with a 1958 amendment to the Internal Revenue Code favoring the small business corporation.

Previous writers in this area have advocated the idea of incorporating the farm business as a possibility for preserving and strengthening the family farm, but those writers have limited them-

selves mainly to broad general discussions of the advantages and disadvantages of the corporate form of business organization.

The characteristics of the corporate structure offer a means for solution of some of the organizational problems confronting the farmer. The corporation is a definite alternative for meeting the farmer's problems of capital accumulation and intergeneration transfer of property. Research currently under way is designed to determine the extent to which or under what conditions the corporate structure is the most logical of the business organizational alternatives.

To facilitate the necessarily intensive approach to the problems the case study method is being employed. Visits are being made to the case study farms which include both incorporated farms and farms on which the corporate structure is being considered.

The conditions in the individual case situations are being studied relative to the attributes of the corporate structure as expressed in a detailed framework of reference. The situation in each case study is being compared and contrasted to the framework of reference in determining situations in which incorporation would be the logical form of business organization. An evaluation of the success of the corporate structure on presently incorporated farms will be made.

The corporate structure is a possibility for meeting many of the organizational needs of the farmer. It is not being studied as a cure for all that ails the family farm. The message to be conveyed here is the possibility of solution of serious problems through minor modifications of an available economic organizational structure and its adaptation to agriculture. Corporate farming does not signify the elimination of the traditional family farm; it may be a major tool for maintaining and increasing the efficiency of the family farm unit.

INDEX

A

B

C

D

INSTRUCTIONS FOR CONTRIBUTORS

Editorial Policy:

Papers and abstracts of papers to be published in the Alabama Academy of Science Journal may be submitted by both Academy and non-Academy members at any time during the year. Priority, however, will be given to material submitted by members of the Alabama Academy of Science.

Full-length papers which are submitted for possible publication will be judged by a review board on the basis of original data presented and upon the interpretation or review made of the materials presented within a limit of 15 printed pages. An article exceeding this limit will be charged at the rate of $10.00 per additional page. Papers must be submitted solely to the Alabama Academy of Science Journal and must not be reprinted in another publication without the consent of the editor.

Manuscripts:

The manuscript should be typed double spaced allowing good margins. Captions and legends for figures should be typed on sheets separate from the text. Footnotes are not desirable and should be avoided whenever possible. Illustrations should not exceed 20 per cent of the text; the authors of more copiously illustrated articles may be asked to pay for the excess. The title of the paper should be as short as is consistent with clarity. Primary divisions may be indicated by central headings and subdivisions by italicized captions at the margin. Every paper should normally conclude with a summary of numbered paragraphs.

Abstracts of papers should not exceed 200 words and should not include illustrated materials except where absolutely necessary.

Figures:

All figures and tables should be numbered consecutively with legends included. Illustrations (including tables) should be planned to occupy the entire width of a page (4½ inches), and any portion of the height (7 inches). It is best to combine illustrations into the smallest possible number of groups. Original photographs should be submitted in the form of clear black and white prints on glossy paper. Care should be taken to see that they cannot be bent or folded in handling, and paper clips should not be used.

References:

References to literature should be cited by the author's name or by the literature cited reference number. The bibliography should be arranged alphabetically by author under the heading Literature Cited. Complete reference is necessary and the arrangement should normally be as follows: Harper, R. M. Some Menaces of the Study of Geology. Jour. of Ala. Academy of Science. 27:15-20. 1955.

Proofs and Reprints:

Galley proofs will be sent to the author, and the corrected proof and reprint order should be returned to the Editor. Page proofs will be sent only when necessary. Cost of reprints will be indicated at the time proofs are mailed. All manuscripts should be handed to the various Section Chairmen at the close of the Annual Academy meeting or mailed directly to the Editor of the Journal. All correspondence concerning the publication of papers, etc., within the Journal should be addressed to the Editor. Correspondence relative to securing copies of the Journal should be addressed to the Archivist.

Alabama

Alabama academy of

JUN

JUN 4 1965